

Environmental Assessment

Shore Fire Control Party Feasibility Study Marine Corps Base, Camp Lejeune Onslow County, North Carolina

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EXECUTIVE SUMMARY

The Marine Corps has prepared this environmental assessment (EA) pursuant to the National Environmental Policy Act (NEPA) of 1969, the Council on Environmental Quality (CEQ) regulations in 40 CFR Parts 1500-1508, and Marine Corps Order P5090.2A.

S.1 Description of the Proposed Action

The Proposed Action is to conduct a one-day Shore Fire Control Party (SFCP) Feasibility Study at Marine Corps Base Camp Lejeune (hereinafter “Camp Lejeune”), North Carolina. This study would be conducted in two phases: Phase I - firing inert (non-explosive rounds, which are actually concrete); and Phase II - live (explosive) naval gunfire (NGF) rounds into the G-10 Impact Area at Camp Lejeune. This phased approach would allow Naval gunners the opportunity to more accurately refine the computer firing solutions and mitigate the risk of targeting error when using live rounds. Once the inert firing is completed, there would be a pause in the study (approximately one hour) for the Commanding General to review the results of Phase I and determine if the study would proceed to Phase II. G-10 is an established Impact Area and has been subject to the discharge of similar ordnance. The proposed Feasibility Study would occur no earlier than mid October 2001.

The purpose of the proposed study is to determine whether Camp Lejeune is suitable to accommodate SFCP Training, which involves indirect NGF, on a routine basis. The study is one step towards fulfilling a need to evaluate alternative East Coast locations for conducting this training. SFCP training is presently limited to Vieques Island, Puerto Rico and San Clemente Island, California. Conducting SFCP training at Camp Lejeune would 1) save money associated with moving people, equipment, and ships to San Clemente Island or Vieques, 2) decrease the number of days personnel are deployed or are away from their homeport or unit by allowing them to train at or near home station, and 3) increase readiness by expanding frequency and opportunities for training.

S.2 Alternatives Considered

The purpose of the study is to determine whether Camp Lejeune is a feasible location to conduct SFCP training, which involves indirect NGF. Therefore, it is the only alternative site for such training addressed in this EA. This EA addresses the Proposed Action and No Action alternatives for conducting the proposed feasibility study.

Locations other than Camp Lejeune may be suitable for SFCP training, which involves NGF. All reasonable alternative locations would be considered, along with Camp Lejeune, in any NEPA

documentation prepared in support of the Marine Corps decision-making process for where to locate such training.

Marine Corps operations and training personnel reviewed Camp Lejeune's training areas, using existing weapons safety footprints, and initially concluded that four areas (the Greater Sandy Run Area (GSRA), the K-2 Impact Area, the N-1/BT-3 Impact Area on Brown's Island, and the G-10 Impact Area) had the potential to accommodate the non-explosive and/or live NGF rounds necessary for the SFCP Feasibility Study. Upon further study, Marine Corps personnel found that the GSRA was not a feasible alternative because it can accommodate only non-dud producing rounds and naval gun rounds would have to be fired over residential/commercial areas within Onslow County. The K-2 Impact Area was eliminated as a feasible alternative because the water depths of Onslow Bay and within the New River would not allow naval ships to get within range of the naval guns (approximately 12 miles [20 kilometers]).

While an impact area can normally accommodate non-explosive and live ordnance, it was determined that the N-1/BT-3 Impact Area on Brown's Island could not safely accommodate live ordnance from NGF due to the proximity of the Atlantic Intracoastal Waterway (AIWW). Given this limitation, the earlier concept for the test firing into the N-1/BT-3 Impact Area on Brown's Island has been eliminated from further consideration.

The G-10 Impact Area can accommodate both inert and live ordnance and is the proposed location for the SFCP Feasibility Study. Because of safety concerns regarding the skipping of inert ordnance, the Marine Corps had developed an earlier concept that included using the N-1/BT-3 Impact Area on Brown's Island for inert rounds. However, upon further evaluation by Camp Lejeune staff of gun targeting capabilities, and the ability to control skipping of inert ordnance through the azimuth of fire, the Marine Corps has determined that firing NGF rounds into the G-10 impact area has no greater chance of producing a skipped round than currently authorized and routinely conducted artillery fire into G-10. New NGF technology uses Global Positioning Systems (GPS), gyro-stabilized guns, and computer generated solutions, enhancing the accuracy of fire.

The No Action Alternative would impair the ability of the USMC to maintain its ability to train Atlantic Fleet forces in the Atlantic Fleet operational area (Section 5063 Title 10 USC) and to integrate the SFCP and naval ship crew training, so that Navy and Marine personnel can train together.

S.3 Environmental Impacts of the Proposed Action

The Feasibility Study would involve NGF. The potential for NGF noise affecting marine mammals would be minimal, as would the potential for ship collisions with marine mammals. The evaluation considered measurements and studies conducted over the past 20 years, and criteria and thresholds for injury and harassment of marine mammals and other protected marine species from impulsive noise developed by the Navy in support of the Seawolf Shock Test FEIS (1998). With the mitigation measures proposed, the potential for injury or harassment under the Marine Mammal

Protection Act, or “takes” of endangered marine mammals and sea turtles, is negligible and there would be no effect.

The Feasibility Study may affect, but is not likely to adversely affect, red-cockaded woodpeckers and rough-leaved loosestrife. Impacts to protected species are highly unlikely due to the short duration and limited intensity of the study. Also, the Feasibility Study would not introduce new impacts to Camp Lejeune habitats, or to species associated with Camp Lejeune or their habitats. Activities with impacts similar to NGF are already ongoing at Camp Lejeune. Thus, there would be no effects on threatened and endangered species.

The Feasibility Study would result in a minor disruption of vehicle and boat traffic through two one-hour closures of NC 172, Lyman Road, and the Atlantic Intracoastal Waterway (AIWW). The AIWW is presently closed about 20 times per year for current Marine Corps training operations. Closing of NC 172 has been less frequent, but has occurred in support of training exercises. Roadblocks would be put in place barring motor traffic on NC 172 and Lyman Road, and boat patrols would be placed on the AIWW to prevent entry into the surface danger zone. Existing warning signs for both facilities would be modified. The USMC would publish a “Notice to Mariners” for the date and time of the Feasibility Study.

The location in Onslow Bay from which Naval ships would fire is greater than 10 mi (16 km) from the closest populated or public areas. Based on the 145-dB level observed at 3,700 ft (1,128 m) and the closest land-to-ship distance (greater than 37,000 ft [11,278 m]), the noise levels on land resulting from NGF would be expected to be in the 90-120 dB range. These levels are considered as low risk of disturbing the public.

Recent technological advances in NSFS Fire Control Systems (e.g., new NGF technology uses GPS, gyro-stabilized guns, and computer generated solutions), munitions, and tactics techniques and procedures have greatly increased the accuracy and reliability of NGF; consequently, Surface Danger Zone (SDZ) and statistical weapon system data show that firing NGF into the G-10 Impact Area would be safe. In fact, improved NSFS safety allows clearance of overhead fires identical to cannon artillery.

The chance of a NGF round skipping is greatly reduced if the projectile is fired at an angle of 10 degrees or higher. The existing Camp Lejeune Range Procedures (Base Order P3570.1A) and Marine Corps Artillery Safety SOP, Appendix J) reduce the chance of skipping even further by prohibiting artillery from shooting at an angle lower than 15 degrees.

In accordance with Camp Lejeune’s existing procedures, naval guns would not fire at an angle of less than 15 degrees during the Feasibility Study. At 15 degrees or greater, NGF has a higher trajectory and falls at a steeper angle than currently authorized artillery operations. The steeper angle of fall results in an even lower probability of skipping a round; therefore, firing NGF rounds into the G-10 impact area has no greater chance of producing a skipped round than currently authorized and routinely conducted artillery fire into G-10.

There are no residences under the gunfire trajectories; the closest residential area to the NGF Impact Area is about 2.5 miles (4 km) away. With respect to State Park operations, the Marine

Corps would inform the North Carolina Division of Parks and Recreation of the date of the Feasibility Study when known.

Based on the safety computations and precautions described above, as well as the phased approach to the study, no significant impacts with respect to safety are expected as a result of the Feasibility Study.

In conclusion, there would be no significant environmental impacts with respect to implementation of the proposed SFCP Feasibility Study at Camp Lejeune.

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List of Acronyms

AGL	Above Ground Level
AIWW	Atlantic Intracoastal Waterway
CAA	Clean Air Act
CAAA	Clean Air Act Amendments
CAMA	Coastal Area Management Act
CERCLA	Comprehensive Environmental Response Compensation & Liability Act
CEQ	Council On Environmental Quality
CFR	Code of Federal Regulations
CINC	Commander-in-Chief
CLDS	Camp Lejeune Dependant Schools
CRTF	Coral Reef Task Force
CWA	Clean Water Act
CZMA	Coastal Zone Management Act
CZMP	Coastal Zone Management Plan
EEZ	Exclusive Economic Zone
EFD	Energy Flux Density
EFH	Essential Fish Habitat
ENMP	Environmental Noise Management Program
EO	Executive Order
EOD	Explosive Ordnance Disposal
EPA	Environmental Protection Agency
ESA	Endangered Species Act
FAA	Federal Aviation Administration
FACSFAC VACAPES	Fleet Area Control and Surveillance Facility, Virginia Capes
FMP	Fishery Management Plan
FSS	Fire Support Station
GPS	Global Positioning Systems
GSRA	Greater Sandy Run Area
HE	Heavy Explosive
HMX	Octogen
IRP	Installation Restoration Program
IAV	Light Armored Vehicle
MCB	Marine Corps Base
MCAS	Marine Corp Air Station
MCCS	Marine Corps Community Services
MCO	Marine Corps Order
MGTF	Marine Air-Ground Task Force
MEU	Marine Expeditionary Unit
MMPA	Marine Mammal Protection Act
NAAQS	National Ambient Air Quality Standards

List of Acronyms

NCDENR	North Carolina Department of Environmental & Natural Resources
NCDOP	North Carolina Department of Transportation
NEPA	National Environmental Policy Act
NGF	Naval Gunfire
NHPA	National Historic Preservation Act of 1966
NMFS	National Marine Fisheries Service
NMS	Noise Monitoring System
NPDES	National Pollutant Discharge Elimination System
NOAA	National Oceanographic and Atmospheric Administration
NSFS	Naval Surface Fire Support
NSWC	Naval Surface Warfare Center
POL	Petroleum, Oils, and Lubricants
RCRA	Resource Conservation and Recovery Act
RCW	Red-Cockaded Woodpecker
RDX	Cyclonite
RLL	Rough-Leaved Loosestrife
SAFMC	South Carolina Fishery Management Council
SAV	Submerged Aquatic Vegetation
SDZ	Surface Danger Zone
SFCP	Shore Fire Control Party
SIP	Stationary Implementation Programs
SOP	Standard Operating Procedure
TLZ	Tactical Landing Zone
TNT	Trinitrotoluene
TSP	Total Suspended Particles
UNC	University of North Carolina
USFWS	US Fish and Wildlife Service
USEPA	US Environmental Protection Agency
USAEHA	US Army Environmental Hygiene Agency
USACHPPM	US Army Center for Health and Promotion and Preventive Medicine
USMC	US Marine Corps
UXO	Unexploded Ordinance
WWTP	Wastewater Treatment Plant

1 PURPOSE AND NEED

The United States Marine Corps (USMC) proposes to conduct a Shore Fire Control Party (SFCP) Feasibility Study at Marine Corps Base (MCB) Camp Lejeune, North Carolina (Figure 1-1). This study would involve firing both inert (non-explosive) and live (explosive) NGF rounds into established impact areas at Camp Lejeune. The proposed Feasibility Study would occur no earlier than mid October 2001.

1.1 Purpose and Need for the Proposed Action

The purpose of the proposed study is to gather information in order to determine if Camp Lejeune is capable of accommodating SFCP training on a routine basis. Conducting SFCP training at Camp Lejeune would 1) save money associated with moving people, equipment, and ships to San Clemente Island or Vieques, 2) decrease the number of days personnel are deployed or are away from their homeport or unit by allowing them to train at or near home station, and 3) increase readiness by expanding frequency and opportunities for training.

This Environmental Assessment (EA) addresses the potential environmental impacts of decisions available to the Base Commander, namely to:

- Approve the Proposed Action (conduct the Feasibility Study); or
- Disapprove the Proposed Action.

1.2 Background

Amphibious landings, attacks launched from the sea by naval and landing forces (Marines), are the hallmark of the Marine Corps. These landings involve the movement of Marine forces and their supporting equipment ashore, while naval aircraft provide close air support (CAS) and naval ships provide naval surface fire support (NSFS). Two types of NSFS are conducted during an amphibious landing:

- **Direct** NSFS is NGF aimed at a target that can be seen from the ship. Direct NSFS is used to take out enemy targets that pose an immediate threat on the beach. Command and control of NGF resides with the supporting naval forces.
- **Indirect** NSFS is NGF directed at enemy targets that cannot be seen from the ship. Marine SFCPs provide coordinates from positions on the beach, at which naval ships direct their fire. In essence, SFCPs become the eyes of the naval ships.

Once target coordinates from SFCPs have been provided to the naval forces offshore, the ship's crew plots the target, compares the target's position to itself, and passes fire control data to the naval gunners. This information is fed to the fire control computers, and double-checked against the position plotted on a map. Weapons handlers then ensure the guns are loaded with the correct ammunition, and finally, the naval guns are fired remotely. SFCPs provide adjustments to the coordinates, as necessary, until the enemy target has been destroyed (US Navy, 2001).

Use of live ordnance is a necessity to determine SFCP performance. Using live ordnance allows the SFCP to determine if the shot was accurate enough to destroy the target. If the target is not destroyed with the first shot then as stated above adjustments to the coordinates need to be made. In addition, live ordnance reinforces strict handling procedures, and develops individuals who know when (or when not) to deliver NGF. Such skills are highly perishable, and practice is absolutely necessary to ensure flawless end-to-end execution of ordnance evolutions (Department of Defense, 1999).

The equipment and skills necessary to conduct effective indirect NSFS are complicated and perishable. At this time, there are only two locations within the US and its territories capable of accommodating this type of training: San Clemente Island, California and Vieques Island, Puerto Rico.

Both training locations challenge the ability of the Marine Corps to provide the required quarterly training for its East Coast-based SFCPs. (The requirement for quarterly training is presented in Marine Corps Order (MCO) 3501.26A.) For instance, the cost of sending one East Coast-based SFCP to San Clemente Island, California (outside of the Atlantic Fleet Operating Area) is almost \$6,000. In addition to this cost, sending East Coast SFCPs to the West Coast is very time consuming, contributing to the time Marines spend away from their home and families and also cutting into the limited time Marine personnel have to train. Besides being expensive and time consuming, training exercises at San Clemente Island do not allow Atlantic Fleet ship crews the opportunity to participate in the NSFS and SFCP training. The integration and coordination of ship crews with its SFCPs is one of the most important aspects of indirect fire NSFS training.

SFCP training at Vieques Island is also costly (nearly \$4,000 per SFCP). The larger constraint at Vieques Island, however, is the significant reduction in NSFS range availability (no more than 90 days per year). Numerous required training exercises compete for the available training days, thereby limiting the amount and flexibility of SFCP training at Vieques Island.

For these reasons, and due to the fact that no other ranges can currently accommodate indirect fire NSFS and SFCP training, a Feasibility Study at Camp Lejeune is proposed. Presently, indirect NSFS and SFCP training is not authorized at any of the training ranges on Camp Lejeune. The results of the proposed Feasibility Study will be used to determine if SFCP training can be conducted at Camp Lejeune on a routine basis. This study is not intended to find a replacement site for NSFS (either direct or indirect fire) training.

1.3 The Environmental Review Process

1.3.1 The National Environmental Policy Act

The National Environmental Policy Act (NEPA) of 1969 requires consideration of the environmental impacts of major federal actions. Detailed environmental impact statements (EISs) must be prepared for those major federal actions with the potential to significantly affect the quality of the human environment. Environmental assessments (EAs) are concise public documents that provide evidence and analysis for determining whether to prepare an EIS or a finding of no significant impact (FONSI), and to aid in an agency's compliance with NEPA when an EIS is not required. The EA should include brief discussions of the need for the proposal, the alternatives, the affected environment, the environmental impacts of the proposed action and alternatives, and a listing of agencies and persons consulted.

This EA has been prepared pursuant to NEPA and the following:

- The Council on Environmental Quality (CEQ) regulations as contained in 40 CFR Parts 1500 to 1508, which direct federal agencies on how to implement the provisions of NEPA; and
- Marine Corps Order (MCO) P5090.2A, which documents the USMC's internal operating instructions on how it implements the provisions of NEPA.

1.3.2 Permits, Approvals, and Agency Coordination

In addition to NEPA, other laws and regulations are applicable to conduct of the proposed Feasibility Study. Specifically, the following would be obtained prior to project implementation:

- Coastal Consistency Determination under the Coastal Zone Management Act (CZMA).

2 ALTERNATIVES, INCLUDING THE PROPOSED ACTION

The CEQ *Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act* establish a number of policies for federal agencies, including “... using the NEPA process to identify and assess the reasonable alternatives to the Proposed Action that will avoid or minimize adverse effects of these actions on the quality of the human environment” (40 CFR 1500.2 (e)). This chapter presents a description of the alternatives development process, alternatives considered that meet the overall purpose and need of the proposed action, a discussion of the no action alternative, and a summary of environmental impacts of each alternative.

2.1 Alternatives Development Process

With an overall objective of finding a potential alternative location to conduct SFCP training that would reduce the high costs of training East Coast-based SFCPs, reduce the time East Coast Marine SFCP personnel are required to spend away from their homes and families, and optimize military commanders’ flexibility in meeting quarterly SFCP training requirements, the Marine Corps determined that Camp Lejeune may be a good location to conduct SFCP training. This determination was based on the following:

- Camp Lejeune has the largest concentration of Marines on the East Coast and is home to eight SFCP teams, consisting of 10 Marines each.
- Camp Lejeune has established training areas for amphibious landings and live and non-explosive ordnance operations and currently hosts the vast majority of Marine Corps training exercises for the East Coast.
- Camp Lejeune is within close proximity (approximately 200 miles (320 km) from the Atlantic Fleet’s concentration of naval vessels (Norfolk, VA).

In order to determine whether the SFCP training is feasible at Camp Lejeune, the Marine Corps proposes to conduct a one-day Feasibility Study of naval gunfire related to SFCP training.

Marine Corps operations and training personnel reviewed Camp Lejeune’s training areas, using existing weapons safety footprints, and initially concluded that four areas had the potential to accommodate non-explosive and/or live NGF rounds necessary for the conduct of SFCP training (Figure 2-1). They were further evaluated as follows:

- **Greater Sandy Run Area (GSRA)** - Marine Corps personnel found that the GSRA was not a feasible alternative because it can accommodate only non-dud producing rounds and that naval gun rounds would have to be fired over residential/commercial areas (portions of Onslow County).
- **K-2 Impact Area** - the K-2 Impact Area was eliminated as a feasible alternative because the water depth of Onslow Bay does not allow naval ships to get within range of the naval guns (approximately 12.4 miles (20 km)).
- **N-1/BT3 Impact Area on Brown's Island** - while an impact area can normally accommodate non-explosive and live ordnance, it was determined that Brown's Island could not safely accommodate live ordnance from NGF due to the proximity of the Atlantic Intracoastal Waterway (AIWW). Given this limitation, the earlier concept for test firing into the N-1/BT-3 Impact Area has been eliminated from further consideration.
- **G-10 Impact Area** – this area can accommodate both inert and live ordnance and is the proposed location for the SFCP Feasibility Study. Because of safety concerns regarding the skipping of inert ordnance, the Marine Corps had developed an earlier concept that included using the N-1/BT-3 Impact Area on Brown's Island for inert rounds. However, upon further evaluation by Camp Lejeune staff of gun targeting capabilities, and the ability to control skipping of inert ordnance through the azimuth of fire, the Marine Corps has determined that firing NGF rounds into the G-10 impact area has no greater chance of producing a skipped round than currently authorized and routinely conducted artillery fire into G-10. New NGF technology uses Global Positioning Systems (GPS), gyro-stabilized guns, and computer generated solutions, enhancing the accuracy of fire.

The firing of non-explosive and live rounds into the G-10 impact area is proposed for the Feasibility Study.

2.2 Proposed Action - Conduct SFCP Training Feasibility Study at Camp Lejeune

Under this alternative, a Feasibility Study for conducting SFCP training would occur at Camp Lejeune at the G-10 Impact Area (Figure 2-2) The information that would be gathered during this study would be used to determine if SFCP training is possible at Camp Lejeune. The Feasibility Study is proposed for one day no earlier than mid October 2001 and is not anticipated to last more than two hours.

The study event would be structured in two phases:

- **Phase I** - firing 12 non-explosive naval gun rounds, which are actually concrete encased in metal jackets, into the G-10 Impact Area at 10-second intervals. Data collected during

this phase would allow the naval gunners the opportunity to more accurately refine the computer firing solutions and mitigate the risk of targeting error when using live rounds. The test will involve observation by air and ground spotters, as well as use of the Weapons Impact Scoring System (radars to measure the accuracy of fire). If something goes wrong during the initial firing of inert rounds, the spotters can relay the information immediately, and the Commanding General, who will be on-site, can stop the test.

- **Phase II** - following the successful firing of inert naval gun rounds, and with the Commanding General's decision to proceed with Phase II, 12 live (explosive) rounds would be fired at 10-second intervals into the G-10 Impact Area. This would involve SFCPs calling in target coordinates from vantage points surrounding the G-10 impact area. SFCP personnel would adjust target coordinates, as necessary, in order to completely destroy the target.

One recently certified Navy destroyer would be used for firing the naval gun rounds. Certification refers to tested competence in the mission-essential tasks, relating to NGF, which naval ships are expected to execute during contingency operations. The Feasibility Study would use a ship with proven capability to hit its intended target. During the conduct of the study, the Navy destroyer would be located approximately 9.3 miles (15 km) from the G-10 Impact Area (along the periphery of the N-1/BT-3 Impact Area).

During both Phases I and II, portions of the AIWW, Lyman Road, and NC 172 would be closed as a safety precaution. Additionally, training areas GC, GD, GE, GH, and GI would be closed during the entire test.

2.3 No Action

Under the No Action alternative, the Feasibility Study for conducting SFCP training at Camp Lejeune would not take place. Without this study the Marine Corps would be unable to gather information in order to determine if Camp Lejeune is a feasible location for SFCP training. East Coast-based SFCP training would continue to be limited by the expense and inefficiencies involved with training personnel at either San Clemente Island or Vieques Island (Subchapter 1.2). Although the No Action alternative does not meet the Marine Corps' purpose and need, it is carried through this EA in order to provide a baseline from which the potential impacts of the proposed action can be compared and as an alternative available to the decision-maker.

2.4 Evaluation of Alternatives

The adverse and beneficial impacts of both the No Action Alternative and the Proposed Action are summarized in Table 2-1.

Table 2-1

Evaluation of Alternatives

Impact	Proposed Action	No Action Alternative
Land Use	The Feasibility Study would be of short duration and use existing ranges and facilities. Thus, there would be no impacts. With respect to Coastal Zone Consistency, the Marine Corps has concluded that the Feasibility Study is consistent to the maximum extent practicable with the Coastal Zone management Program of North Carolina. The NC Department of Environment and Natural Resources has concurred with this conclusion. Thus, there would be no significant land use impacts.	No impact.
Socioeconomics	The Feasibility Study would involve no permanent or temporary increase or relocation of personnel. It would involve only a small number of personnel in an SFCP (only 10 personnel), all of whom are currently stationed at Camp Lejeune. The action is consistent with the two Presidential Executive Orders on Environmental Justice (EO 12898 and 13045). Thus, there would be no significant socioeconomic impacts.	No impact.
Community Facilities and Services	The Feasibility Study does not involve relocation of, or increases in the number of, personnel at Camp Lejeune. The participating personnel in the SFCP would already be stationed at Camp Lejeune. Thus, there would be no increase in demand for community facilities and services and no significant impacts.	No impact.
Transportation	NC 172, Lyman Road, and the Atlantic Intracoastal Waterway (AIWW) would be temporarily closed for two one-hour periods during the day of the study. Camp Lejeune has procedures in place for closure of roadways (MCP 3570.1A) and has temporarily closed roads on prior occasions. The Navy has coordinated with both the Corps of Engineers and the Coast Guard concerning the proposed temporary closure of the AIWW, which has been closed in the past. Thus, there would be no significant transportation impacts.	No impact.
Air Quality	The testing is of short duration and the explosive products from the live rounds are similar to those generated by ongoing training activities at Camp Lejeune. The detonation process, including the continued combustion that occurs in the plume immediately after initial detonation, results in nearly complete combustion of these explosive compounds to form oxides of carbon, nitrogen, and water. Thus, there would be no significant air quality impacts.	No impact.
Noise	Noise from troop movements would not be significant as only 10 personnel would be involved. Noise from sonic booms from incoming rounds would be within standards to protect swimmers and would be more than 10 miles (16 kilometers) from the closest populated or public areas. Thus, there would be no significant noise impacts.	No impact.
Infrastructure	The SFCP would be made up of 10 personnel, all of whom are currently based at Camp Lejeune. No additional troops would be stationed at Camp Lejeune for this Feasibility Study. Therefore, there would be no impacts to water supply, wastewater treatment, or solid	No impact.

	waste facilities.	
Cultural Resources	All known architectural and archeological National Register sites are clearly marked and avoided during military training exercises. Furthermore, the areas to be used for the Feasibility Study have been extensively disturbed during previous training exercises. Thus, there would be no significant impacts to cultural resources.	No impact.
Water Resources	The inert shells are composed essentially of concrete and would not adversely affect water quality. The explosive products from the live shells are similar to those generated by ongoing training activities in G-10. The nearly complete combustion of explosive compounds would result in little contaminants being deposited on the ground. Thus, there would be no significant water resource impacts.	No impact.
Marine Natural Resources	The sounds generated by 5"/54 naval gun firing would all be below injury and harassment levels for marine mammals beyond 98 ft (30 m) from the ship. The closeness of the 98 ft (30 m) radius in conjunction with the standard operating procedures that would be implemented by the Navy to watch for the presence of marine mammals and abort operations until the area has been cleared if marine mammals are present would ensure that no marine mammals would be harassed. Ship collisions with marine mammals and sea turtles would be avoided through a series of mitigation measures. Potential, but unlikely, impacts to fish would not have a significant effect on overall fish stocks. No impacts to Sargassum, live/hard bottom habitat, or coral reefs would occur. Thus, there would be no significant impacts to marine natural resources .	No impact.
Land Natural Resources	The G-10 Impact Area has been used historically, and is still used, for live fire training. Camp Lejeune has managed G-10 area in regards to this mission and has also incorporated mitigation measures, for example, for the present red-cockaded woodpecker and rough-leaved loosestrife habitats. Thus, it has been determined that the Feasibility Study is not likely to affect threatened and endangered species. In summary, there would be no significant impacts to land natural resources.	No impact.
Hazardous Materials/Waste	Detonation of the live rounds results in the nearly complete combustion of explosive compounds. Thus, it is unlikely that significant quantities of any compounds would be released to the environment. Marine Corps personnel will follow Base Order MCO P3570.1 with regard to the handling of hazardous materials; petroleum, oils, and lubricants; and, unexploded ordnance. Thus, there would be no significant with respect to hazardous materials or wastes.	No impact.
Safety	The principal safety issue with respect to the Feasibility Study is the potential for inert rounds to skip. The Marine Corps has determined that firing NGF rounds into the G-10 impact area has no greater chance of producing a skipped round than currently authorized and routinely conducted artillery fire into G-10. New NGF technology uses Global Positioning Systems (GPS), gyro-stabilized guns, and computer generated solutions, enhancing the accuracy of fire Thus, there would be no significant safety impacts (refer to Section 4.13).	No impact.

3 AFFECTED ENVIRONMENT

This chapter, as required by the CEQ regulations for implementing NEPA (40 CFR Part 1500-1508), provides a description of the environment that would be affected by the proposed action. The description is focused on those features of the environment that, because of the nature of the activities proposed, would potentially be affected by the one-day SFCP Feasibility Study at Camp Lejeune.

3.1 Land Use

This subchapter discusses on-site and off-site land use patterns on Camp Lejeune and the neighborhoods nearest to the G-10 Impact Area.

3.1.1 Camp Lejeune

Camp Lejeune is located in Onslow County in southeastern North Carolina (Figure 1-1), approximately halfway between Wilmington and New Bern. The Base provides specialized training for amphibious and land combat operations to the 2nd Marine Division, the nucleus of the Marine Corps' east coast force-in-readiness. The Camp Lejeune Complex, including the Marine Corps Base, the New River Air Station, and the Greater Sandy Run Training Area covers approximately 153,000 acres (62,000 ha) on both sides of the New River. The northern boundary of Camp Lejeune adjoins the City of Jacksonville, and the southern boundary extends to the Atlantic Ocean.

G-10 is one of three main impact areas (K-2 and N-1/BT-3 being the others) on Camp Lejeune. Most other ranges are dedicated to special purposes (rifle ranges, Special Operations Training Group ranges, etc.). Generally, ammunition from other live fire ranges, gun positions, and mortar positions will impact onto one of the three main impact areas.

The G-10 Impact Area is a bombing and target range and is entirely over land. It is undeveloped, except for a variety of temporary targets, and is characterized by a variety of upland and wetland forest types, some open grasslands, and ponds (Figure 3-1). It is primarily used for air-to-ground exercises, indirect and direct fire weapons, infantry weapons fire, and as an impact area for anti-tank guided missiles.

3.1.2 Surrounding Communities

Camp Lejeune is located within Onslow County. The county seat and primary commercial center is the city of Jacksonville, adjacent to and north of the military complex. In 1990, the city of Jacksonville annexed much of Camp Lejeune within its municipal boundary, including its

associated Marine Corps Air Station (MCAS) New River. However, the Marine Corps maintains exclusive legislative jurisdiction within the vast majority of the military complex as federal land.

Regional land uses around Camp Lejeune are influenced by the presence of large areas of land within the coastal plain that are ecologically unsuitable for development. Development constraints include extensive areas of wetlands, federal and state land, water bodies, high erosion areas and flood plains, and soil limitations such as wetness, rapid permeability, slow permeability, or low strength.

Acreages associated with principal land uses for the entire area under Onslow County's regulatory jurisdiction are shown in Table 3-1.

Table 3-1
Onslow County Generalized Land Use 1997

Use	Acres (Hectares)	Square Miles (Square Kilometers)	Percent of Total
Residential	16,050 (6,495)	25.1 (65)	5.6
Developed Non-Residential	8,520 (3,448)	13.3 (34)	3.0
Total Developed	24,570 (9,944)	38.4 (100)	8.6
Agriculture	48,680 (19,700)	76.1 (197)	17.0
Forested	203,960 (82,543)	318.6 (825)	71.1
Water Bodies	9,630 (3,897)	15.0 (39)	3.3
Wetlands*	133,780 (54,141)	209.0 (541)	46.6
Note: * Overlaps other categories. Source: Onslow County, July 1998.			

Residential development in Onslow County is concentrated in the Jacksonville area and the county's several smaller municipalities. In 1990, there were 40,526 occupied housing units and an additional 6,868 vacant units. Almost 28 percent of these are held for seasonal or occasional use reflecting the coastal character in the south of the county. Between 1992 and 1997, Onslow County recorded substantial new residential development, with 170 new subdivisions, comprised of 2,389 lots, being approved. Swansboro Township accounted for 47.5 percent of this growth.

Commercial and industrial uses are concentrated within the incorporated areas, with the city of Jacksonville serving as the county's commercial center and accommodating its only industrial park. Outside of the incorporated areas, the county estimates that commercial and industrial zones account for about three percent of the area under the county's regulatory jurisdiction (Onslow County, July 1998). Strip commercial development is a feature in Jacksonville, particularly along Marine and Western Boulevards. The county airport, Albert J. Ellis Airport,

which is located in western Onslow County off Route 111, occupies approximately 700 ac (283 ha).

The major institutional uses (schools, churches, health services, etc.) are located mostly within the incorporated areas in proximity to the residential population. Major institutional uses are Camp Lejeune, Hofmann Forest (owned by Duke University), and Hammocks Beach State Park, which together account for about 30 percent of the county's land area.

There are no residences under the gunfire trajectories; the closest residential area to the NGF Impact Area is about 2.5 miles (4 km) away.

3.1.3 Coastal Zone Management

The North Carolina Coastal Area Management Act (CAMA) was passed in accordance with the federal Coastal Zone Management Act (CZMA) of 1972. CAMA required local governments in each of the 20 coastal counties in the state to prepare and implement a land use plan and ordinances for its enforcement. Upon approval by the North Carolina Coastal Resources Commission, the plan becomes part of the North Carolina Coastal Management Plan. Coastal zone management policies adopted in each plan must be consistent with established state and federal policies. Specifically, policy statements are required on resource protection; resource production and management; economic and community development; continuing public participation; and storm hazard mitigation, post-disaster recovery, and evacuation plans. These policies are discussed in detail in Subchapter 4.2.2.

Onslow County recently updated its *Land Use Plan* in conformity with the CAMA (Onslow County, July 1998). The county has zoning control applicable to only one special area (Golden Acres in Stump Sound Township). The county does, however, require review of subdivisions, providing for minimum design standards, enforced by the county Planning Department. Incorporated areas, such as Jacksonville, implement their own zoning regulations with an extension of these controls one mi (1.6 km) beyond their borders.

3.2 Socioeconomics

Demographic and employment data are presented for Onslow County, the city of Jacksonville, and the state of North Carolina. Much of the Camp Lejeune military complex has been part of the city of Jacksonville since 1990.

3.2.1 Demography

Total population for Onslow County and recent trends are shown in Table 3-2. Among all surrounding North Carolina counties, Onslow is the largest in population. It witnessed substantial growth in the 1980s, although it experienced significant out-migration in the 1990s.

Census data on the 1990 racial and ethnic make-up of Onslow County and the city of Jacksonville populations are shown in Table 3-3. Onslow County has similar proportions of white and black populations as North Carolina as a whole, although the overall proportion of “non-white” residents is higher. African-Americans are found in higher proportion in rural Jones and Duplin counties, and in the city of Jacksonville. Persons of Hispanic origin are few except in Onslow County (5.3 percent) and Jacksonville (4.7 percent), indicating their association with the military complex.

3.2.2 Income and Employment

Median household and family incomes reported from the 1990 Census for 1989 are shown in Table 3-4. In 1989, Onslow County had median incomes noticeably lower than the state as a whole. The percentage of persons reporting income below the poverty threshold reflected a similar distribution.

3.3 Community Facilities and Services

There are a range of emergency services and community facilities that serve Camp Lejeune. The Camp Lejeune Fire Protection Division provides firefighting and hazardous materials services to the Camp Lejeune complex. The Provost Marshal’s office serves as the primary police station for the military police force. The Naval Hospital, located on Northeast Creek near Stone Street and Brewster Boulevard, provides services to Camp Lejeune military personnel, dependents, and retirees. The hospital provides medical and administrative support to all military personnel assigned to the Camp Lejeune complex and has cooperative agreements with civil authorities in the region for emergencies. School-age children of military families residing at the Camp Lejeune complex attend the Camp Lejeune Dependents Schools (CLDS) system. The Marine Corps Community Services (MCCS) offices for the Camp Lejeune military complex provide a full range of recreational services and on-station facilities to military personnel and their dependents (MCB Camp Lejeune, 1998).

Table 3-2

Population Trends 1980-2002

Jurisdiction	1980	1990	1997 Estimate	2002 Projected	1980-1990	1990-1997	1997-2002
Onslow County	112,784	149,838	147,352	156,196	32.9	-1.7	6.0
Jacksonville City	18,259	30,398	75,527	n/a	66.5	148.5	n/a
North Carolina	5,880,095	6,632,448	7,431,161	7,931,133	12.8	12.0	6.7
Source: NC Office of State Planning, 1998, 2001.							

Table 3-3

Race and Ethnicity 1990 (Percent)

Jurisdiction	White	Black ¹	Other Non-White	Hispanic ²
Onslow County	74.6	19.9	5.6	5.3
Jacksonville City	66.5	26.3	7.2	4.7
North Carolina	75.6	21.9	2.5	1.0
Note: 1. Having origins in any of the black racial groups of Africa. 2. Hispanic origin, may be of any race. Source: US Department of Commerce, 1990.				

Table 3-4

Income

Jurisdiction	1989			1995
	Median Household Income	Median Family Income	Percent of Persons Below Poverty	Per Capita Income ¹
Onslow County	23,386	24,857	12.1	14,897
Jacksonville City	25,698	27,144	11.9	n/a
North Carolina	26,647	31,548	13.0	18,521
Note: 1. 1995 estimates from NC Department of Commerce, 1998. Source: US Department of Commerce, 1990.				

3.4 Transportation

3.4.1 Roadways

The main road in the vicinity of Camp Lejeune is US 17 (Ocean Highway), running roughly north-south, connecting Jacksonville with Wilmington, NC, about 51 mi (82 km) to the south, and New Bern, NC, about 36 mi (58 km) to the north. Jacksonville is also connected to the remainder of the region by US 258/NC 24 northwest to I-40, NC 53 southwest to I-40, and NC 24 east to a series of coastal towns, terminating near Morehead City. Both US 17 and NC 24 are divided, multi-lane facilities with three lanes in each direction in the urbanized area near Jacksonville. NC 172 is a two-lane roadway connecting NC 24 just east of Camp Lejeune with Sneads Ferry and other communities to the south and southeast (Figure 3-2). It is almost entirely within Camp Lejeune. Lyman Road is a two-lane roadway, internal to Camp Lejeune, that runs along the northern boundary of the G-10 Impact Area.

3.4.2 Atlantic Intracoastal Waterway

The Atlantic Intracoastal Waterway (AIWW), which extends for almost the entire length of the East Coast, passes through Camp Lejeune between the beaches and the mainland.

There are no data available for the number of non-military (commercial and recreational) annual boat trips on the AIWW. However, 6,675 boats (commercial and recreational) were registered in Onslow County as of December 31, 1998 (NC Wildlife Resources Commission, 1999). These boats are launched on the New River, Queens Creek, the White Oak River, and other waters within the county. Many of these boats pass through the AIWW to enter or exit the New River estuary and Onslow Bay. In addition, there is transient boat traffic (largely recreational vessels) passing through the AIWW from other areas.

The Marine Corps conducts ongoing boat and amphibious training and readiness operations at Camp Lejeune. Most of these operations occur on the New River, Pamlico Sound, or within Onslow Bay, with use of the AIWW for travel between these areas. Several such operations occur every training (normal week) day, involving one to several boats. These maneuvers generally share these waterways with commercial and recreational water traffic. In some instances, the Marine Corps will close surface danger zones and restricted areas within the AIWW and Onslow Bay to prevent civilians and other non-participating craft from entering the operations area. There are currently about 20 operations per year requiring closure of the surface danger zone. Most closures last about one hour. Camp Lejeune can close it at anytime for as long as is deemed necessary consistent with 33CFR Part 334.440.

3.5 Air Quality

The US Environmental Protection Agency (USEPA), under the requirements of the 1970 Clean Air Act (CAA) as amended in 1977 and 1990, has established National Ambient Air Quality Standards (NAAQS) for six contaminants, referred to as criteria pollutants (40 CFR 50). These are carbon monoxide, nitrogen dioxide, ozone, particulate matter, lead, and sulfur dioxide. The NAAQS standards include primary and secondary standards. The primary standards were established at levels sufficient to protect public health with an adequate margin of safety. The secondary standards were established to protect the public welfare from the adverse effects associated with pollutants in the ambient air.

The North Carolina Department of Environment and Natural Resources (NCDENR) has adopted the USEPA's NAAQS as the statewide ambient air quality standards. When the USEPA amended the standard for particulate matter, changing the regulated pollutant from total suspended particulates (TSP) to PM₁₀ (PM₁₀: diameter ≤ 10 micrometers) that is inhalable, the NCDENR adopted the PM₁₀ standard but continued to use both PM₁₀ and TSP as monitoring indicators for the level of particulate matter. Therefore, the North Carolina ambient air quality standards include all of the NAAQS, plus a standard for TSP.

Areas that meet the NAAQS standard for a criteria pollutant are designated as being in "attainment"; areas where the criteria pollutant level exceeds the NAAQS are designated as being in "nonattainment." Nonattainment areas are subcategorized based on the severity of their pollution problem (marginal, moderate, serious, severe, or extreme). When insufficient data exist to determine an area's attainment status, it is designated "unclassifiable" (or "in attainment"). Camp Lejeune and Onslow County are located in the Southern Coastal Plain Intrastate Air Quality Control Region, which is defined in 40 CFR Part 81.152, and is comprised of 13 counties. Pursuant to 40 CFR Part 81.334, each of the 13 counties that make up the Region has been designated as being in attainment for all criteria pollutants.

The Clean Air Act Amendments (CAAA) of 1990 expand the scope and content of the CAA's conformity provisions by providing a more specific definition of conformity. As stipulated in CAAA Section 176(c), conformity is defined as "conformity to the State Implementation Program's (SIP) purpose of eliminating or reducing the severity and number of violations of the NAAQS and achieving expeditious attainment of such standards."

The USEPA published final rules on general conformity that apply to federal actions in areas designated nonattainment for any of the criteria pollutants under the CAA (40 CFR Parts 51 and 93) in the November 30, 1993 *Federal Register*. Since the proposed action would occur within an attainment area, this rule is not applicable to the project.

3.6 Noise

In 1990, noise levels from military exercises around the perimeter of Camp Lejeune were studied through a noise monitoring program by the US Army Environmental Hygiene Agency (USAEHA) (Table 3-5, Figure 3-3). The measurements were conducted separately for continuous noise levels resulting from aircraft and ground vehicle operations, and for impulsive noise levels from ordnance delivery. The monitored Day Night Sound Levels (DNLs) indicate that two of the continuous monitoring noise sites (Tactical Landing Zone (TLZ) Lark and the Dixon School) experience “normally incompatible” noise levels (65 - 75 dBA) due to ground vehicle and aircraft operations and two of the impulsive noise monitoring sites (Willis Landing and TLZ Canary) experience a high risk of complaints of weapon blast noise during training exercises.

Table 3-5

Noise Environment at Camp Lejeune

Site	Continuous Noise Level (DNL - dBA)		Percent of Impulsive Noise Level (dBp)		
	With aircraft	Without aircraft	110-125 dBp	125-135 dBp	>135 dBp
TLZ Robin	59.7	58.6	40.0	0.0	0.0
TLZ Lark	71.4	70.1	N/A	N/A	N/A
Willis Landing	64.1	62.5	39.9	2.0	0.1
TLZ Canary	59.2	57.7	43.7	7.0	0.0
Dixon School	65.9	65.9	50.0	0.0	0.0
Verona Gate	59.5	59.3	60.2	0.0	0.0
Source: US Army Environmental Hygiene Agency, 1990.					

Numerous studies have revealed that health effects can result from continuous noise, such as that occurring near highways, construction sites, and cities with heavy traffic and large airports. However, ambient noise conditions at Camp Lejeune are greatly influenced by impulsive noise generated by bomb explosions or gun firing on the Base’s ranges, and this noise is fundamentally different from continuous noise sources. Thus, the noise threshold criteria for impulsive noise are different than for continuous noise. Permanent damage to unprotected ears due to continuous noise occurs at approximately 85 dBA based on an eight-hour-per-day exposure, while the threshold for permanent damage to unprotected ears due to impulsive noise is approximately 140 dBp (dB Peak) based on 100 exposures per day (Pater, 1976).

In 1991, the USAEHA, now the US Army Center for Health and Promotion and Preventive Medicine (USACHPPM), provided guidelines for evaluating peak blast noise levels generated from military tests and training (Table 3-6). Although these criteria have never been officially adopted, the Army has used them for many years. The USACHPPM conducted a study to correlate annoyance with measured dBp (US Department of the Army National Guard Bureau, 1996) and concluded that:

- dBP criteria are useful for noise complaint management and investigation; and
- dBP provides a good estimate of the perceived vibration of typical residential construction resulting from blasts.

Table 3-6

Guidelines for Evaluating Peak Blast Sound Level

Predicted Sound Levels (dBP)	Risk of Noise Complaints	Action
< 115	Low	Fire all programs
115 - 130	Moderate	Fire important tests; postpone non-critical testing, if feasible
130 - 140	High, and possibility of damage	Only extremely important tests should be fired
> 140	High risk of physiological and structural damage claims	Postpone all explosive operations
Source: US Army Environmental Hygiene Agency, 1990.		

3.7 Infrastructure

The G-10 Impact Area is serviced by a number of dirt roads and tracks, and six observation towers, located not within the impact area itself but in the peripheral ranges. There are no utility systems, but there are a large number and variety of targets (37 targets including abandoned cranes, tanks, trucks, semi-trailers, and buses) within the impact area.

3.8 Cultural Resources

The National Historic Preservation Act (NHPA) of 1966 and subsequent amendments were passed to provide for the protection, enhancement, and preservation of any property that possesses significant archaeological, architectural, historical, or cultural characteristics. Executive Order 11593 of 1974 further defined the obligations of federal agencies concerning this act.

Under Section 106 of the NHPA, the head of any federal agency having direct or indirect jurisdiction over a proposed federal or federally-financed undertaking is required, before the expenditure of any federal funds on that undertaking, to account for its effects on any district, site, building, structure, or object that is included or is eligible for inclusion in the National Register of Historic Places. Under Section 110 of the NHPA, each federal agency is required to establish a program to locate, inventory, and nominate to the Secretary of the Interior all

properties under its ownership or control that appear to qualify for inclusion in the National Register.

Camp Lejeune has developed a draft Historic Preservation Plan (1987) identifying current and potential National Register sites. Additional cultural resource studies are currently underway on Camp Lejeune. Proposed activities are reviewed for their potential to affect known cultural resources.

3.9 Water Resources

The Atlantic Ocean (Onslow Bay) borders Camp Lejeune to the south and east. The New River and its tributaries drain most of the installation and divide it into approximately equal halves.

The state of North Carolina has assigned water quality classifications for all surface waters in the state based on the existing and contemplated “best usage” for which the waters must be protected. Within the tidal portions of the New River, water quality classifications range from SA (the highest rating for tidal waters) to SC (the lowest classification for tidal waters). Class SA waters are suitable for shellfishing and any of the uses specified for “SB” and “SC” classifications. Within the New River estuary, all waters downstream from Grey Point to the New River Inlet at the Atlantic Ocean are classified as SA.

Class SB waters are suitable for primary recreation and other uses as specified by the SC classification. SB waters at Camp Lejeune include the Atlantic Ocean and the tidal portions of Wallace Creek and its two tributaries, Bearhead and Beaverdam Creeks. All other tidal waters within the boundaries of Camp Lejeune north (upstream) of Grey Point are classified as SC (i.e., waters suitable for aquatic life propagation and survival, fishing, wildlife, and secondary recreation (NCDEHNR, 1990a in NAVFACENGCOM, Atlantic Division, 1993)). All non-tidal waters on the Base are classified as “C” waters, which, similar to their tidal counterparts, are suitable for aquatic life propagation and survival, fishing, wildlife, and secondary recreation.

The Water Quality Act of 1987 expanded the National Pollutant Discharge Elimination System (NPDES) coverage to include regulation of stormwater discharges. Appropriate documentation has been filed with the NCDENR for stormwater discharges at Camp Lejeune. Camp Lejeune employs Best Management Practices for both quality and quantity control, and has developed a Stormwater Pollution Prevention Plan.

Groundwater resources supply Camp Lejeune’s potable water needs. In the Jacksonville area, as in much of eastern North Carolina, there are four principal aquifer systems: the unconfined surficial or Water Table Unit; the confined Castle Hayne Unit; the Cretaceous Upper Sand Unit; and the Cretaceous Lower Sand Unit. Based on the depths of these various layers, the thickness of the Castle Hayne Unit, and the depths of the wells on Camp Lejeune, most of Camp Lejeune’s wells withdraw water from the Castle Hayne Unit. This unit yields large amounts of hard,

calcium-bicarbonate-type water (Camp Lejeune, 1988). There are no wells located within the G-10 Impact Area.

3.10 Marine Natural Resources

3.10.1 Marine Mammals

The species of marine mammals found in Onslow Bay immediately offshore from Camp Lejeune are generally those species associated with warm temperate or tropical conditions. Table 3-7 lists the marine mammal species that are indigenous to waters off North Carolina. This list includes both toothed and baleen whales.

Mysticetes (Baleen Whales)

Mysticetes (baleen whales) tend to use North Carolina waters either as a wintering ground or to pass through during migrations. They occupy this area only seasonally and probably do not feed while there (Lee and Socci, 1989). Mysticetes, in general, are more common in shallow shelf waters than shelf-edge and slope waters (Kenney and Winn, 1987).

Records for baleen whales included the northern right whale (*Eubalaena glacialis*), fin whale (*Balaenoptera physalus*), humpback whale (*Megaptera novaeangliae*), sei whale (*Balaenoptera borealis*), Bryde's whales (*Balaenoptera edeni*) and minke whale (*Balaenoptera acutorostrata*).

Northern right whales are generally found off the coast of North Carolina from January to March with recorded sightings from September to April. During their northward migration, they usually transit the coast in shallow waters (Lee and Socci, 1989). The southward fall migration appears to occur far out to sea and could account for the limited fall recordings (Lee, 1985). Preferred water depths during recent surveys off the Florida coast range from ten ft (three m) to 239 ft (73 m), with a mean of 41 ft (13 m) (Kraus et al., 1993).

Fin whales have been reported wintering off Onslow Bay in shallow waters (15 to 20 fathoms or 27 to 37 m) and have been observed in deep water (greater than 300 fathoms or 549 m) (Lee and Socci, 1989). Most North Carolina record sightings are from 15 January to 10 April.

Humpback whales off North Carolina are generally distributed in shallow water (11 to 40 fathoms or 20 to 73 m), similar to that found in the northeastern US (CeTAP, 1982; Lee and Socci, 1989). Sightings peak off North Carolina in spring (April and May) and fall (September to December).

Table 3-7

Marine Mammals Found in North Carolina Waters

Order	Common Name	Scientific Name	Protection Status*
Mysticetes	Northern Right Whale	<i>Eubalaena glacialis</i>	Endangered/MMPA
	Fin Whale	<i>Megaptera novaeangliae</i>	Endangered/MMPA
	Humpback Whale	<i>Balaenoptera physalus</i>	Endangered/MMPA
	Sei Whale	<i>Balaenoptera edeni</i>	MMPA
	Bryde's Whale	<i>Balaenoptera borealis</i>	Endangered/MMPA
	Minke Whale	<i>Balaenoptera acutorostrata</i>	MMPA
Odontocetes	Sperm Whale	<i>Physeter macrocephalus</i>	Endangered/MMPA
	Pygmy Sperm Whale	<i>Kogia breviceps</i>	MMPA
	Dwarf Sperm Whale	<i>Kogia simus</i>	MMPA
	Antillean beaked whale	<i>Mesoplodon europaeus</i>	MMPA
	True's Beaked Whale	<i>Mesoplodon mirus</i>	MMPA
	Dense-beaked Whale	<i>Mesoplodon densirostris</i>	MMPA
	Sowerby's Beaked Whale	<i>Mesoplodon bidens</i>	MMPA
	Goose-beaked Whale	<i>Ziphius cavirostris</i>	MMPA
	Harbor Porpoise	<i>Phocoena phocoena</i>	MMPA
	Bottlenose Dolphin	<i>Tursiops truncatus</i>	MMPA
	Atlantic Spotted Dolphin	<i>Stenella frontalis</i>	MMPA
	Pantropical Spotted Dolphin	<i>Stenella attenuata</i>	MMPA
	Short-Finned Pilot Whale	<i>Globicephala macrorhynchus</i>	MMPA
	Long-Finned Pilot Whale	<i>Globicephala melas</i>	MMPA
	Killer Whale	<i>Orcinus orca</i>	MMPA
	False Killer Whale	<i>Pseudorca crassidens</i>	MMPA
	Pygmy Killer Whale	<i>Feresa attenuata</i>	MMPA
	Striped Dolphin	<i>Stenella coeruleoalba</i>	MMPA
	Spinner Dolphin	<i>Stenella longirostris</i>	MMPA
	Clymene Dolphin	<i>Stenella clymene</i>	MMPA
Pinnipeds	Harbor Seal	<i>Phoca vitulina</i>	MMPA
	Gray Seal	<i>Halichoerus grypus</i>	MMPA
	Harp Seal	<i>Phoca groenlandica</i>	MMPA
	Hooded Seal	<i>Cystophora cristata</i>	MMPA
Sirens	Manatee	<i>Trichechus manatus</i>	Endangered/MMPA
Source: NUWC, 1999. Notes: * MMPA indicates protected by the Marine Mammal Protection Act. "Endangered" means listed as an endangered species under the Endangered Species Act.			

There are few records of sei whales in North Carolina waters although this species is probably a relatively common migrant off the North Carolina coast (Lee and Socci, 1989). The sei whale is thought to occur over the Continental Shelf. Similarly, there are limited records for Bryde's whales in this region because it is difficult to differentiate from sei whales due to the similarity of appearance.

Lee (1986) indicated that minke whales may winter off the North Carolina coast, but are absent during other seasons. Manomet Bird Observatory (1989) recorded rare sightings of this species in summer, autumn, and winter (i.e., two to five individuals/100 transects) on the shelf north of Cape Hatteras. Like most other baleen whales, minke whales typically occupy the shelf proper, rather than the shelf edge (Blaylock et al., 1995).

Odontocetes (Toothed Whales)

Sperm Whales

Sperm whales, in general, utilize deep shelf-edge waters and are found principally along the 6,560 ft (2000 m) isobath. They are also associated with Gulf Stream waters, particularly where cold and warm waters interface (Waring et al. 1992). Sperm whales can be found off North Carolina year round, but sighting data seem to indicate a peak in spring and summer months. Pygmy and dwarf sperm whales (*Kogia* spp.) are less common than sperm whales in the North Carolina region but exhibit a similar oceanic distribution (CeTAP, 1982; Mullin et al., 1991).

Beaked Whales

Several beaked whales (family Ziphiidae) such as the Antillean beaked whale (*Mesoplodon europaeus*), True's beaked whale (*M. mirus*), dense-beaked whale (*M. densirostris*), Sowerby's beaked whale (*M. bidens*) and goose-beaked whale (*Ziphius cavirostris*) occur in North Carolina's offshore waters throughout the year (Lee, 1986; Waring et al., 1997, 1999). Distribution of the family Ziphiidae in the northwestern Atlantic is known primarily from stranding records and limited observations in deep waters (CeTAP, 1982; Lee, 1986; Mead, 1989; Waring et al., 1992; Hooker and Baird, 1999). They have an offshore distribution and have been observed along the north, middle, and south walls of the Gulf Stream into the Sargasso Sea (CeTAP, 1982; Lee, 1986; Mead, 1989; Waring et al., 1992). The beaked whales can generally be found in shelf-break waters with a distribution centered about the 6,560 ft (2,000 m) isobath (which is a line of constant depth) (CeTAP, 1982; Waring et al., 1992). Lee (1986) noted some deep-water records (>500 fathoms) of goose-beaked whales in North Carolina waters.

Delphinids

Delphinid whales (Delphinidae), a group that includes dolphins, killer whales, and porpoises, are by far the most numerous group off North Carolina. Several of the species found in these waters are widely distributed in tropical, warm-temperate, and temperate waters of the world and can be

truly cosmopolitan in nature (Waring et al., 1992, 1997, 1999). Bottlenose dolphins (*Tursiops truncatus*), spotted dolphins (*Stenella frontalis* and *S. attenuata*), and pilot whales (*Globicephala* spp.) are strongly associated with the shelf-edge (656 ft [200 m] isobath) and north wall of the Gulf Stream as well as on to the shelf and seaward into pelagic waters (CeTAP, 1982; Lee, 1986; Kenney and Winn, 1986, 1987; Payne and Heinemann 1993; Waring et al., 1992, 1997, 1999).

Other delphinids found here are at the fringes of their distributions, appearing in the survey data in very low numbers. These include killer whales (killer whale - *Orcinus orca*, false killer whale - *Pseudorca crassidens*, and pygmy killer whale - *Feresa attenuata*), and striped dolphins (striped dolphin - *Stenella coeruleoalba*, long-snouted spinner dolphin - *S. longirostris*, and short-snouted dolphin - *S. clymene*).

The only representative of the porpoise family (Phocoenidae) found in the Onslow Bay waters is the harbor porpoise (*Phocoena phocoena*). This species is generally found in shallow shelf waters and feeds on demersal fishes (Gaskin, 1977; CeTAP, 1982; Kraus, 1983; Lee, 1986; Palka, 1995). During the fall and spring, harbor porpoises can be found dispersed as far south as the Carolinas (Waring et al., 1997, 1999). There are stranding records as far south as Florida (Smithsonian strandings database), but North Carolina waters may be at the southern limit of its range on the US Atlantic coast.

Pinnipeds

Several pinnipeds, a group that includes seals, walruses, and sea lions, appear in the data for North Carolina. These include the harbor seal (*Phoca vitulina*), gray seal (*Halichoerus grypus*), harp seal (*Phoca groenlandica*), and hooded seal (*Cystophora cristata*). These animals maintain a link to land for both mating and giving birth on shore (Nowak, 1991), and are encountered in coastal habitats (Waring et al., 1997, 1999).

Manatees

Manatees (*Trichechus manatus*) are reported to be uncommon but regular visitors to the North Carolina coastline and its estuaries during the warmer months (Lee and Socci, 1989). In these waters, they may occur at beach fronts and sounds, while in Florida, they have been known to travel up freshwater rivers (Lee and Socci, 1989).

3.10.2 Sea Turtles

Five species of sea turtles occur in the Atlantic coastal waters off the eastern US, including the continental shelf and shelf break regions, as follows:

- Hawksbill (*Eretmochelys imbricata*);
- Leatherback (*Dermochelys coriacea*);
- Green (*Chelonia mydas*);
- Loggerhead (*Caretta caretta*); and

- Kemp's ridley (*Lepidochelys kempii*).

All five species have been found in North Carolina and may occur in Onslow Bay. North Carolina waters appear to be the furthest point north in the Atlantic Exclusive Economic Zone (EEZ) that sea turtles can be found throughout the year. They have been sighted throughout the winter as far north as Oregon Inlet in the Outer Banks of North Carolina (Epperly et al., 1995). In these waters, there is a seasonal inshore-offshore pattern of movement. In the January to March time period, virtually all sea turtle sightings occurred offshore. Sightings are equally divided between inshore and offshore waters during May and June. During the April to December time period, there is generally a large inshore distribution. This inshore-offshore pattern of movement suggests that sea turtles move offshore in the winter toward warmer Gulf Stream waters and back inshore in the spring as the coastal waters warm.

Epperly et al. (1995) conducted aerial surveys of sea turtles and used satellite-derived images of sea surface temperatures to relate sea turtle distribution to the physical oceanography of the North Carolina area. A clear association of turtles with warm shallow waters west of the Gulf Stream was found to be apparent in Raleigh, Onslow, and Long Bays. Turtles were usually sighted when Gulf Stream influences, indicated by surface temperatures greater than or equal to 52° F (11° C), reached within 17 mi (28 km) of shore in the survey zone. Turtles were not sighted when Gulf Stream influences were further offshore of the survey zone. Shoreside distribution of turtles is addressed in Subchapter 3.11.5

3.10.3 Fisheries

Onslow Bay

Over 50 species of fish are harvested from Onslow Bay and other North Carolina marine waters. Some of the important finfish from these waters include summer flounder (*Paralichthys dentatus*), Atlantic croaker, bluefish, striped mullet (*Mugil cephalus*), weakfish (*Cynoscion regalis*), mackerel (*Scomberomorus cavalla* and *S. maculatus*), grouper (*Epinephelus* spp.), and spot (*Leiostomus xanthurus*). Sharks (Squaliformes) are becoming an increasingly important component of the commercial fishery in Onslow Bay. More menhaden (*Brevoortia tyrannus*) are caught in Onslow Bay than any other species.

Important shellfish harvested from Onslow Bay and other marine waters include blue crab, shrimp, scallops (*Aequipecten* and *Placopecten* spp.), and hard clams (US Navy, 1999).

New River and AIWW

The New River ranks among the better North Carolina estuaries for recreational fishing. Common species found in the river, the AIWW, and the associated tidal creeks include flounder (*Paralichthys* spp.), spot, croaker (*Micropogonius undulatus*), weakfish (*Cynoscion regalis*), bluefish (*Pomatomus saltatrix*), and black sea bass (*Centropristes striata*). Although nearly half

of the commercial finfish landings in North Carolina are anadromous species, the New River contains relatively fewer anadromous fish stocks (Sholar, 1975 in: LANTDIV NAVFACENGCOM, June 1993).

In addition to finfish, the New River and AIWW provide habitat for many shellfish. Common species associated with the estuary and nearby waters include blue crab (*Callinectes sapidus*), shrimp (*Penaeus* spp.), hard clams (*Mercenaria mercenaria*), and American oyster (*Crassostrea virginica*). The soft substrate of the New River estuary provides habitat for a wide variety of benthic invertebrates that serve as a food source for many of the fish that frequent its waters. Some flats are intermittently exposed at low tide, and these areas, along with adjacent tidal marshes provide foraging habitat for a variety of terrestrial invertebrates. Additional high quality habitat is provided by beds of submerged aquatic vegetation (SAV). Eelgrass (*Zostera marina*) provides food for waterfowl and cover for crabs, fish, and shrimp (LANTDIV NAVFACENGCOM, June 1993).

Essential Fish Habitat

The Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) (16 USC 1801), enacted in 1996, establishes US management authority over all fishing within the Exclusive Economic Zone (EEZ); all anadromous fish throughout their migratory range; and all fish on the continental shelf. Additionally, the act called for the establishment of eight Regional Fishery Management Councils to be responsible for the preparation of fishery management plans (FMPs) to achieve optimum yields from US fisheries in their regions. The act amended the 1976 Magnuson Act and directed the establishment and protection of essential fish habitat (EFH). Federal agencies must consult with the National Marine Fisheries Service (NMFS) on any proposed action that may adversely affect EFH.

There are two essential fish habitats associated with Onslow Bay:

- **Live/Hard Bottom Habitat** - Scattered irregularly over the continental shelf, live/hard bottom habitat is made up of zones of highly concentrated invertebrate and algal growth, in association with marked deviations in topographical relief that support substantial fish assemblages. Lime outcrops covered with live, deep-water corals occur in scattered locations in Onslow Bay. These locations tend to be along the shelf edge, outside and seaward of the N-1/BT-3 range.
 - **Sargassum Habitat** - Pelagic brown algae (*Sargassum natans* and *S. fluitans*) form a dynamic structural habitat within warm waters of the western North Atlantic. Pelagic sargassum is considered essential fish habitat because it provides protection, feeding opportunity, and use as a spawning substrate to a variety of fish species (SAFMC, 1998). The presence of this habitat within the Onslow Bay site is transient, and dependent on prevailing surface currents (occasional pieces of sargassum may float through the area).
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3.10.4 Protected Species

All marine mammals are protected by the Marine Mammal Protection Act (MMPA) passed in 1972 and amended in 1988 and 1994. The MMPA, subject to limited exceptions, prohibits any person or vessel subject to the jurisdiction of the United States from “taking” marine mammals in the United States or on the high seas without authorization. “Taking” includes any harm or harassment. Section 101(a)(5) of the MMPA directs the Secretary of the Department of Commerce to allow, upon request, the incidental (but not intentional) taking of marine mammals by US citizens who engage in a specified activity (exclusive of commercial fishing) within a specified geographical region if certain findings are made and regulations are issued.

In addition to the MMPA, the Endangered Species Act (ESA) of 1973, as amended, authorizes National Oceanic and Atmospheric Administration Fisheries (NOAA Fisheries) and the US Fish and Wildlife Service (USFWS) to provide special protection to species whose numbers are considered depleted or whose existence is threatened. The ESA prohibits jeopardizing endangered and threatened species, adversely modifying critical habitats essential to their survival, or the taking of individuals through direct or indirect means. Section 7 of the act requires consultation with NOAA Fisheries and USFWS to determine whether any endangered or threatened species under their jurisdiction may be affected by the proposed action. The Navy and Marine Corps ensure that consultations are conducted as required with the USFWS and NOAA Fisheries under Section 7 for any action that may affect a threatened or endangered species according to guidance provided in the *Environmental Resources Program Manual* (MCO P5090.2).

Table 3-8 lists threatened and endangered species found in the nearshore and offshore waters near Camp Lejeune. Of the marine mammal species found off the North Carolina coast, six are endangered: the northern right, sei, fin, humpback, and sperm whales, and the manatee. The occurrence and distribution of these species in North Carolina waters has been described in Subchapter 3.10.1. Two of the five sea turtle species are endangered (hawksbill and leatherback). The occurrence and distribution of these turtles has been described in Subchapter 3.10.2. Shoreside distribution of threatened and endangered species is addressed in Subchapter 3.11.5

3.10.5 Coral Reefs

On June 11, 1998 President Clinton issued Executive Order (EO) 13089 on Coral Reef Protection (63 Fed. Reg. 32701) which directs federal agencies to identify their actions that may affect US coral reef ecosystems, to use their authorities and programs to protect and enhance these ecosystems, and, to the extent permitted by law, ensure that any actions they authorize, fund, or carry out will not degrade the conditions of coral reef ecosystems. The EO defines “coral reef ecosystems” as those species, habitats, and other natural resources associated with coral reefs in all maritime areas and zones subject to the jurisdiction or control of the United States, including reef systems in the South Atlantic, Caribbean, Gulf of Mexico, and Pacific Ocean.

Table 3-8

Federally-Listed Animals near Camp Lejeune
in Nearshore and Offshore Waters

Species	Federal Status
REPTILES	
Hawksbill sea turtle (<i>Eremochelys imbricata</i>)	Endangered
Leatherback sea turtle (<i>Dermochelys coriacea</i>)	Endangered
Green sea turtle (<i>Chelonia mydas</i>)	Threatened
Loggerhead sea turtle (<i>Caretta caretta</i>)	Threatened
Kemp's ridley sea turtle (<i>Lepidochelys kemp</i>)	Threatened
MAMMALS	
West Indian manatee (<i>Trichechus manatus</i>)	Endangered
Northern right whale (<i>Eubalaena glacialis</i>)	Endangered
Sei whale (<i>Balaenoptera borealis</i>)	Endangered
Fin whale (<i>Balaenoptera physalus</i>)	Endangered
Humpback whale (<i>Megaptera novaeangliae</i>)	Endangered
Sperm whale (<i>Physeter macrocephalus</i>)	Endangered

As indicated in Subchapter 3.10.3, lime outcrops covered with live, deep-water corals occur in scattered locations in Onslow Bay. However, these locations tend to be along the shelf edge, outside and seaward of the N-1/BT-3 range. Although coral covers these outcrops they are not considered coral reefs, which are generally limited in distribution to those waters where temperatures do not drop below 68°F (20°C).

3.11 Land Natural Resources

3.11.1 Topography, Geology, and Soils

Camp Lejeune and Onslow County are located within the Coastal Plain physiographic province of North Carolina. Elevations on the Base range from sea level to 72 ft (22 m) above mean sea level (MSL). Surface relief varies from marshlands in the south to low, gently rolling hills in the northwest and northeast (LANTDIV NAVFACENGCOM, October 1999). The New River and its tributaries have associated floodplains of various widths. Outside the floodplains, the terrain is relatively flat, characterized by xeric sand flats and ridges or mesic-to-wet inter-stream flats and shallow depressions (LANTDIV NAVFACENGCOM, October 1999).

Soils of Camp Lejeune can generally be described as rock free, sandy in character, with low organic matter and low fertility. A total of 31 soil series are found throughout Camp Lejeune. Most of these soils are classified as sandy loams, and nearly half of the soils on Base are somewhat poorly drained, poorly drained, or very poorly drained. Those soils that are sandy are generally well drained and quite suitable for construction. These include Baymeade fine sands that cover nearly one-third of the Base (Barnhill 1992).

The G-10 Impact Area, like the rest of Camp Lejeune, is characterized by relatively low relief, with the highest elevation at about 15 ft (4.6m) MSL. Slopes range from 0 to 5 percent in most exercise locations. Soils types include Kureb, Leon, and Baymeade fine sands, and much of the area is wetland. A majority of the soils are not classified as having significant erosion potential.

3.11.2 Floodplains

Executive Order 11988 sets forth the responsibilities of federal agencies in reducing the risk of flood loss or damage to personal property, minimizing the impacts of flood loss, and restoring the natural and beneficial functions of floodplains. This order was issued in furtherance of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

Floodplains and flood hazard zones are present on Camp Lejeune near the New River and its creeks and estuaries. These areas have been mapped and are available on the Base's GIS systems. Within G-10, minor floodplains are associated with two small tributaries of French Creek.

3.11.3 Vegetation and Wetlands

The major plant communities found on Camp Lejeune are pine forests, mixed pine-hardwood forests, hardwood forests, pond pine (*Pinus serotina*), and estuarine marshes. Approximately 45 percent of the Base forested area is comprised of loblolly pine (*Pinus taeda*), 12 percent is in longleaf pine (*Pinus australis*), and 8 percent is in pond pine. The mixed pine-hardwood component occupies about 22 percent of the Base, and the pure hardwood component occupies about 17 percent. Wiregrass (*Aristida stricta*), Broadleaf uniola (*Uniola latifolia*), American holly (*Ilex opaca*), titi (*Cyrilla racemiflora*), wax myrtle (*Myrica cerifera*), greenbrier (*Smilax* spp.), poison ivy (*Toxicodendron radicans*) honeysuckle (*Lonicera japonica*), cutover muhly (*Muhlenbergia* spp.), toothache grass (*Ctenium aromaticum*), panic grasses (*Panicum* spp., *Dicanthelium* spp.), little bluestem (*Andropogon scoparius*), and associated grasses and forbs characterize the understory vegetation over most of the area.

Wetlands occur throughout Camp Lejeune. Due to the low relief of Camp Lejeune, the preponderance of poorly drained soils on the Base, and the proximity of the New River and AIWW, wetland habitats are a prominent feature at Camp Lejeune. A recent basewide Wetlands Management Plan identified a total of approximately 67,000 ac (27,115 ha) of wetlands and open

water habitats at Camp Lejeune (including the GSRA). These wetlands can be categorized according to the USFWS National Wetland Inventory classifications as palustrine forested, palustrine emergent, palustrine scrub-shrub, estuarine emergent, and/or estuarine scrub-shrub.

Palustrine forested wetlands include plant communities typed as pure pond pine, mixed pond pine-hardwood, marshes, pocosins, and wooded swamps. These communities comprise the major acreages of wetland on the Base. Most wetlands on the Base occur in the floodplains and river valleys, but can also occur on inter-stream flats characterized by poor drainage or as tidal marshes shoreward of the barrier islands. The general location of wetlands on the Base is available through the Base's GIS system. Within G-10, wetlands are generally palustrine forested or scrub-shrub (longleaf pine savannahs, pond pine pocosins, and streamhead pocosins).

3.11.4 Wildlife

Bird species common to the New River estuary and barrier island marshes include waterfowl such as Canada goose (*Branta canadensis*), mallard (*Anas platyrhynchos*), gadwall (*A. strepera*), green-winged teal (*A. crecca*), American widgeon (*A. americana*), northern shoveler (*A. clypeata*), ruddy duck (*Oxyura jamaicensis*), wood duck (*Aix sponsa*), canvasback (*Aythya valisneria*), lesser scaup (*Aythya affinis*), bufflehead (*Bucephala albeola*), and common merganser (*Mergus merganser*). Wading birds associated with tidal marshes and mudflats include clapper rail (*Rallus longirostris*), Virginia rail (*Rallus limicola*), whimbrel (*Numenius phaeopus*), greater yellowlegs (*Tringa melanoleuca*), short-billed dowitcher (*Limnodromus griseus*), little blue heron (*Egretta caerulea*), snowy egret (*E. thula*), American egret (*Casmerodius albus*), great blue heron (*Ardea herodias*), and glossy ibis (*Plegadis fulcinellus*).

A number of other bird and several reptiles (mostly turtles, terrapins, and snakes) also make use of the estuary, particularly its marshes. Of note is the American alligator (*Alligator mississippiensis*) that nests in the brackish waters of the major tributaries.

Camp Lejeune is also home to a variety of mammals and birds. Common mammals occurring on forest/open land edges include: white-tailed deer (*Odocoileus virginianus*), eastern gray squirrel (*Sciurus carolinensis*), fox squirrel (*Sciurus niger*), eastern cottontail (*Sylvilagus floridanus*), marsh rabbit (*Sylvilagus palustris*), opossum (*Didelphis marsupialis*), and raccoon (*Procyon lotor*). Common bird species include: mourning dove (*Zenaida macroura*), northern bobwhite quail (*Colinus virginianus*), starling (*Sturnus vulgaris*), mockingbird (*Nimus polyglottos*), robin (*Turdus migratorius*), sparrow (Fringillidae), and warbler (Parulidae) (MCB Camp Lejeune, September 1987).

Songbirds, birds of prey, and small mammals frequent wildlife openings that primarily have been cleared within forests for game species. Many bird species nest at Camp Lejeune, and many other species, including neotropical migrant birds, stop, rest, and forage at Camp Lejeune on their journey.

The G-10 Impact Area provides habitat for many of the mammal and bird species typically found at Camp Lejeune.

3.11.5 Threatened and Endangered Species

The species listed as federally threatened or endangered at Camp Lejeune are identified in Table 3-9. Locations of the endangered red cockaded woodpecker (individuals and tree nest cavities) have been mapped by Marine Corps personnel for the G-10 Impact Area (Figure 3-4). Figure 3-4 also shows the mapped locations of the endangered rough-leaved loosestrife at the G-10 Impact Area.

Rough-leaved Loosestrife

The federally endangered rough-leaved loosestrife (RLL) is found in 27 known aggregations primarily in the margins of wet pine woodland throughout the Base. Two concentrations or groups are located within 0.4 mi (600 m) of the proposed NGF target area within the G-10 Impact Area. These sites are within the Surface Danger Zone for the G-10 Impact Area, and are thus subject to impacts from ongoing operations. With the exception of RLL sites within the G-10 Impact Area, habitat is marked by single white bands of paint on trees along the perimeter of a 100-ft buffer zone. Because of the threat of unexploded ordinance and the fact that no ground training occurs within the G-10, RLL sites occurring in the impact area are not marked.

Seabeach Amaranth

The federally threatened seabeach amaranth is an herbaceous plant emerging on sand dunes, inlets and over-wash flats in summer and early fall. Because it is an annual, it is rarely seen in the same location for two consecutive seasons. The most persistent locations for seabeach amaranth have been between New River Inlet and Onslow South Tower, which are considerably south of the G-10 Impact Area. Thus, it can be reasonably expected that no seabeach amaranth occurs in the G-10 Impact Area.

Red-cockaded Woodpecker

Camp Lejeune contains 65 red-cockaded woodpecker (RCW) cavity tree clusters, including 14 sites within the buffer zone of the G-10 Impact Area (Table 3-10). There are no sites within the NGF Impact Area. Red-cockaded woodpeckers generally range about 0.5 mi (0.8 km) to forage. Only two of the 14 clusters have suitable foraging habitat within the target buffer area, and the cluster closest to the proposed NGF target is 0.8 mi (1.3 km) away. Both clusters with suitable foraging habitat within the buffer area lie within the Surface Danger Zone for G-10 and are currently subject to artillery impacts. Data collected by Camp Lejeune indicates that the clusters closest to the proposed NGF target area have had relatively high productivity over the last ten years, with averages ranging from 1.3 to 2.2 fledglings per year.

Table 3-9
Federally-Listed Plants and Animals in Onslow County, North Carolina

Species	Federal Status
PLANTS	
Seabeach amaranth (<i>Amaranthus pumilus</i>)	Threatened
Rough-leaved Loosestrife (<i>Lysimachia asperulaefolia</i>)	Endangered
Cooley's meadowrue (<i>Thalictrum cooleyi</i>)	Endangered
BIRDS	
Red-cockaded woodpecker (<i>Picoides borealis</i>)	Endangered
Piping plover (<i>Charadrius melodus</i>)	Threatened
Bald eagle (<i>Haliaeetus leucocephalus</i>)	Threatened
REPTILES	
American alligator (<i>Alligator mississippiensis</i>) ¹	Endangered
Hawksbill sea turtle (<i>Eretmochelys imbricata</i>)	Endangered
Leatherback sea turtle (<i>Dermochelys coriacea</i>)	Endangered
Green sea turtle (<i>Chelonia mydas</i>)	Threatened
Loggerhead sea turtle (<i>Caretta caretta</i>)	Threatened
Kemp's ridley sea turtle (<i>Lepidochelys kemp</i> i)	Threatened
Source: USFWS, Raleigh, NC Field Office. Note: ¹ American alligator is listed as endangered due to similarity of appearance with another species that is endangered, and is listed for the protection of that species. This species is not biologically endangered or threatened and is not subject to Section 7 consultation. Eastern cougar is not included in this table because even though it is listed as a protected species, there have been no verified sightings in decades, and this species is generally considered to have been extirpated from the region.	

Table 3-10
Red-cockaded Woodpecker Group Productivity-Groups within the G-10 Impact Area Buffer Zone

Cluster	90	91	92	93	94	95	96	97	98	99	Sum	Avg.
14	2	4	3	2	3	3	3	1	2	3	26	2.6
15	0	2	2	2	2	1	0	3	1	2	15	1.5
16	*	0	1	2	0	3	2	2	3	1	14	1.56
17	1	0	0	2	2	2	3	2	2	2	16	1.6
23	2	2	2	2	0	0	3	2	2	3	18	1.8
24	1	0	0	1	1	0	2	3	0	1	9	0.9
25	2	0	0	3	3	0	0	2	2	1	13	1.3
26	0	*	1	2	1	0	3	2	0	3	12	1.33
27	4	2	2	1	2	2	3	3	0	3	22	2.2
28	3	1	0	2	2	1	1	2	2	3	17	1.7
37	0	1	1	0	2	2	1	2	1	3	13	1.3
43	*	1	1	0	2	3	2	3	2	2	16	1.78
50	*	*	*	*	*	*	*	2	1	3	6	1.5
51	*	*	*	*	*	*	*	0	2	3	5	1.25

In 1979, the USFWS issued a Biological Opinion relative to the effects of mechanized infantry training on Camp Lejeune in specified areas of RCW habitat. This opinion provided for guidelines that eliminated the likelihood of jeopardy to the species.

The woodpecker cluster sites on Camp Lejeune are protected from normal maneuver operations by a 200-foot buffer zone clearly marked with single bands of white paint and signs reading “Restricted Area Endangered Species Site, No Vehicles Allowed, And Endangered Species Colony Site.” Tracked and wheeled vehicles are restricted to existing well-defined, main roads/trails in these areas. Activities prohibited in RCW management areas include digging/disturbing tree roots, burying cable, cutting pine trees, stringing cable through trees, and setting up command posts or bivouacking.

In 1999, Camp Lejeune consulted with the USFWS with regard to: depiction of the G-10 Impact Area in the latest Camp Lejeune Military Installation Map; target modification within the G-10 relative to RLL and RCW habitat; and mitigating actions to offset potential impacts to federally-listed species. The USFWS concurred with the Base’s conclusion that use of the latest military installation map may affect but is not likely to adversely affect federally-listed species at the installation. The USFWS also agreed with Camp Lejeune’s position that target realignment within the G-10 Impact Area may affect but is not likely to adversely affect federally-listed plants or animals.

Piping Plovers

While piping plovers may use beach areas on or near Camp Lejeune for winter foraging and possibly nesting, they are not expected to be present in the G-10 Impact Area.

Sea Turtles

Loggerhead and green turtles have historically used the Onslow Beach area of Camp Lejeune for nesting between the months of June and August. However, they would not be present in the G-10 Impact Area.

American Alligator

The threatened American alligator is found in the waters surrounding Camp Lejeune. Alligators have been sighted in the New River watershed (Camp Lejeune). No current management areas have been designated on the Base. This species is listed as threatened due to similarity of appearance with another endangered species and is listed for the protection of that species.

State-Listed Species

The federally-listed threatened and endangered species are also considered threatened or endangered by the state of North Carolina. In addition to these species, the state lists two other species occurring within the G-10 Impact Area as endangered, namely golden crest (*Lophiola aurea*) and pine barrens smoke grass (*Muhlenbergia torreyana*). Four candidates for state-listing

also occur within the G-10 buffer area – Harper’s beak sedge (*Rhynchospora harperii*), pond spice (*Litsea aestivalis*), Savannah milkweed (*Asclepias pedicellata*), and Hooker’s milkwort (*Polygala hookerii*). It is not known whether these occur within the impact area.

3.12 Hazardous Materials/Wastes

This subchapter addresses hazardous materials and hazardous waste management in compliance with the Resource Conservation and Recovery Act (RCRA) on the Base, and potential hazardous waste contamination areas.

3.12.1 Hazardous Materials and Waste Management

The *Standard Operating Procedures for Range Control* (Base Order P3570.1) establish environmental restrictions and procedures for use of the ranges. There are procedures governing a number of environmental concerns, including the handling of hazardous materials and petroleum, oils, and lubricants (POL). These procedures include:

- Spill control and response;
- Disposal of battery waste; and
- Fuel storage.

In addition, impact areas are periodically swept in conjunction with semi-annual retargeting operations for the purpose of neutralizing hazards associated with unexploded ordnance (UXO). Those ranges that are used frequently, or which accumulate an excessive amount of UXO, are swept more frequently, as often as scheduling permits. The sweeps and disposal are conducted by trained and authorized explosive ordnance disposal (EOD) personnel.

3.12.2 Installation Restoration Program Sites

Hazardous waste contamination areas are well known on Camp Lejeune and are being investigated as part of the DoD’s Installation Restoration Program (IRP). This program was instituted to satisfy the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) for former and current hazardous waste sites.

The use and handling of ordnance is regulated under the USEPA’s Military Munitions Rule (40 CFR Parts 260 - 266, 270). USEPA excludes the application of RCRA to ranges used for training with, or the testing of, munitions, as well as range clearance as part of range management activities. However, DoD organizations must pursue aggressive range management policies that ensure compliance with existing regulations and promote environmental stewardship (*Interim Policy for DoD Implementation of the EPA Military Munitions Rule*, 14 February 1997).

Because of its active range status, the G-10 Impact Area is not considered an IRP site.

3.13 Safety

The *Standard Operating Procedures for Range Control* (Base Order P3570.1) establishes standard operating procedures designed to ensure safety during the use and discharge of various types of weapons and the use of weapons platforms. In addition to the procedures governing the impact areas, Base Order P3570.1 sets restrictions on the use of various types of ordnance and the conduct of various types of operations.

4 ENVIRONMENTAL CONSEQUENCES

This chapter presents an analysis of the potential impacts upon various components of the environment that could result from the SFCP Feasibility Study at Camp Lejeune. It follows a format similar to that of Chapter 3.

As stated in Chapter 2, the only alternative to conducting the SFCP Feasibility Study at Camp Lejeune is the No Action alternative. The No Action alternative would continue the status quo; thus, there would be no change in the existing conditions as discussed in Chapter 3.

4.1 Land Use

4.1.1 General

The Feasibility Study would be of short duration (two one-hour intervals) and would involve the use of existing ranges and facilities that have historically been used for the training of Marine Corps personnel using weapons and explosive devices. Thus, there would be no significant impacts with respect to land use and zoning.

4.1.2 Coastal Zone Management

Pursuant to the Coastal Zone Management Act of 1972 (16 U.S.C. 1451 et seq.), any federal agency activity within or outside the coastal zone that affects any land or water use or natural resource of the coastal zone must be carried out to the maximum extent practicable with the enforceable policies of approved State Management programs. North Carolina has an approved coastal management program that defines the coastal zone or “coastal area” as comprising 20 coastal counties, including Onslow County, in which Camp Lejeune is located, and extending three miles (4.8 km) seaward.

Onslow County’s CZM policies, which have been approved by the NC Coastal Resources Commission, are listed in Table 4-1. These policies are applied by the NC Department of Environment and Natural Resources (NCDENR) during their review process. The policy statements apply to:

- CAMA minor and major permitting as required by NCGS 113A-118 prior to undertaking any development in any area of environmental concern;
- Establishment of local planning policy; and

Table 4-1

Onslow County
Land Use/Coastal Zone Management Policy Categories

Resource Protection Policies	Applicability
Soils:	
Septic tank use	no
Wetlands protection	yes
Flood Hazard Area:	
Coordinate development in floodplains with NCDRC, FEMA, COE	no
Groundwater/Protection of Potable Water Supplies:	
Support stormwater runoff regulations	no
Coordinate activities involving USTs installed/abandoned	no
Coordinate ground water protection with adjacent counties	no
Manmade Hazards:	
Coordinate UST regulations with state	no
Expansion of Albert Ellis Airport per Master Plan	no
No bulk storage of hazardous materials in urban areas	no
No toxic waste dump sites in county or on military property	yes
No disposal of toxic wastes in county	no
Stormwater Runoff:	
Support state stormwater runoff regulations	no
Support control of agricultural runoff	no
Support control of forestry runoff	no
Design projects to limit possible stormwater runoff to estuarine waters	no
Cultural/Historic Resources:	
Protect significant architectural/archaeological/cultural resources	no
Industrial Impacts on Fragile Areas	no
Package Treatment Plant Use	no
Marina and Floating Home Development	no
Mooring Fields	no
Off-Road Vehicles – No restrictions	no
Development of Sound and Estuarine Islands	no
Bulkhead Construction	no
Sea Level Rise	no
Maritime Forests:	
Encourage acquisition of high quality tracts for conservation	no
Development of residential nature	no
Estuarine System – develop water dependent uses along Estuarine Shoreline AEC	no
Protection of Outstanding Water Resources at Stump Sound and Bear Island	no
Water Quality Management in White Oak and Cape Fear Basins	no
Community Attitude Toward Resource Management and Production	no
Recreation Resources:	
Support access to waterfront/shoreline	yes
Apply for grant funds	no
Priority to repairing/replacing damaged/destroyed shoreline access facilities	no
Support year-round recreation program	no
Prepare county-wide comprehensive recreation plan	no
Allow golf courses if meet buffer requirements and other regulations	no
Peat or Phosphate Mining	no

Table 4-1 (Continued)

Onslow County
Land Use/Coastal Zone Management Policy Categories

Resource Protection Policies	Applicability
Sewer System:	
Provide water systems to county residents and study expansion	no
Secure grant funding	no
Support "created" wetlands for treating waste effluent	no
Solid Waste:	
Support operations of new county landfill	no
Support education on recycling and waste reduction	no
Support siting of recycling centers in all areas except conservation	no
Support clean community projects	no
Energy Facility Siting and Development:	
Review any applications for electric-generating plants	no
Support preparation of an EIS for new energy-related facilities	no
Community Facilities	no
Redevelopment of Developed Areas	no
Land Use Regulation/Urban Growth Patterns:	
Encourage urban development near existing urban areas	no
Permit residential development to meet market needs	no
Enforce existing regulations	no
Estuarine Access	yes
Types and Locations of Desired Industry	no
Commitment to State and Federal Programs	no
Assistance to Channel Maintenance	no
Assistance in Interstate Waterways	no
Transportation:	
Identifies specific roadway improvements	no
Identifies specific improvements to Albert Ellis Airport	no
Land Use Trends:	
Development of "404" wetlands	no
Expansion of central water and sewer areas	no
Increasing traffic on US 17 and NC24	no
Continued support of economic and industrial development	no
Development of an industrial park	no
Establishment of county wide zoning	no
Development of a new solid waste disposal facility	no
Support the US MCAS New River and Albert Ellis Airport	no
Intergovernmental cooperation	no
Expansion of county-wide recreational opportunities	no
Reduction of the county's substandard dwelling units	no
Low elevation and sea level rise	no
Regulation of nonpoint sources of water pollution	no
Control of development in fragile areas	no
Regulation of corporate farms and increased agricultural runoff	no
Continuing Public Participation Policies	no
Storm Hazard Mitigation	no

- Review of proposed projects requiring state or federal assistance or approvals to determine consistency with local policies.

The policies with relevance to the Feasibility Study include:

- Wetlands protection;
- Exclusion of toxic waste dumps from county or military property;
- Support for access to the waterfront/shoreline;
- Provide estuarine access.

The *Standard Operating Procedures for Range Control* (Base Order MCO P3570.1) restricts activities in wetlands and the disposal of petroleum, oils and lubricants (POL) and other toxic/hazardous materials.

The Feasibility Study would, on one day for about two hours, interfere with the public's access to the waterfront/shoreline and surrounding estuarine areas. The areas that would be closed are Surface Danger Zones (SDZs) and restricted areas established by the Corps of Engineers for the purpose of Marine Corps personnel training; thus, this impact would not be significant.

Per a March 20, 2001 telephone conference with North Carolina Division of Coastal Management, this EA includes a consistency statement. The Feasibility Study is consistent with past and continuing activities at Camp Lejeune involving the firing of large caliber weapons (e.g., howitzers), which have been consistent with Camp Lejeune's mission and with the Coastal Zone Management Program. The Feasibility Study is, therefore, consistent to the maximum extent practicable with the Coastal Zone Management Program of North Carolina. The State of North Carolina concurred with this position in a May 4, 2001 letter to Camp Lejeune.

4.2 Socioeconomics

4.2.1 General

The Feasibility Study would involve no permanent or temporary increase or relocation of personnel. It would involve only a small number of personnel in an SFCP (only 10 personnel), all of whom are currently stationed at Camp Lejeune. Thus, there would be no significant demographic or economic impacts due to implementation of the study.

4.2.2 Environmental Justice

Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations" requires consideration of whether the Proposed Action would disproportionately affect minority or low-income groups. The analyses in this EA

support the conclusion that the Feasibility Study would have no significant environmental effects; thus, there would be no disproportionately high or adverse environmental health or safety impacts to minority or low-income populations. Guidance provided by the Council on Environmental Quality (CEQ 1997) and USEPA (1998) has been considered in developing this analysis.

Similarly, the potential of the Feasibility Study to generate disproportionately high environmental health and safety risks to children, which must be addressed as required by Executive Order 13045 (“Protection of Children from Environmental Health Risks”), is minimal. This Executive Order was prompted by the recognition that children, still undergoing physiological growth and development, are more sensitive to adverse environmental health and safety risks than adults.

4.3 Community Facilities and Services

The Feasibility Study does not involve relocation of, or increases in the number of, personnel at Camp Lejeune. The participating personnel in the SFCP would already be stationed at Camp Lejeune. Thus, there would be no increase in demand for community facilities and services.

The Base would utilize its own emergency and fire services should the need arise. Considering the brief nature of the proposed study, no significant increase in demand for these services is anticipated.

4.4 Transportation

The only impact on transportation facilities would be brief closures of NC 172, Lyman Road, and the AIWW (two one-hour intervals). NC 172 is a two-lane roadway that connects NC 24 to the communities southwest of Camp Lejeune. Much of the road is within the boundaries of the Base; it is this portion that would be closed. Lyman Road is entirely within the Base.

During the study, roadblocks would prevent use of the roadways by civilians and non-participating personnel. Existing warning signs would be modified to alert travelers of the study. Camp Lejeune has procedures in place for closure of roadways (MCP 3570.1A) and has temporarily closed NC 172 on prior occasions. Closing the roadways would provide the necessary clearances required for the conduct of overhead fire.

The Marine Corps has coordinated with both the Corps of Engineers and the Coast Guard concerning the proposed temporary closure of the AIWW. The N-1/BT-3 Impact Area has an associated restricted area/SDZ already established by the Corps of Engineers for the Marine Corps’ use for training operations. The AIWW is currently closed about 20 times per year, with each closure generally lasting about one hour. The Feasibility Study would be a one-time event

that would result in about two additional hours (at one-hour intervals) of closure in 2001, and would not constitute a significant impact.

Procedures for closure include publishing a Notice to Mariners, blocking the channel at the north and south boundaries of the Base, and conducting a surface sweep to ensure no unauthorized persons are within the training area. The Base personnel also conduct aerial sweeps to determine the presence of unauthorized persons, marine mammals, and sea turtles.

All airspace over Camp Lejeune is subject to Federal Aviation Administration (FAA) regulations. A major portion of the Base lies within airspace designated by the FAA as Restricted Areas R-5306D and R-5306E. Through a joint letter of agreement signed by the Commanding Generals, 2d MarDiv, 2d MAW, 2d FSSG, and Camp Lejeune, and under MCO P3570.1, Range Control is the scheduling authority for these restricted spaces. The Range Control Duty Officer must notify the Cherry Point Air Traffic Control Facility of the intended use of the airspace by 1600 on the preceding day(s). In addition, Warning Area W-122 overlies Onslow Bay, and is controlled by the Fleet Area Control and Surveillance Facility, Virginia Capes (FACSFAC VACAPES) located at NAS Oceana in Virginia Beach, Virginia.

Both R-5306D and R-5306E include airspace from surface to 17,999 ft (5,486 m) above ground level (AGL). The maximum height of the test fire would be 9,600 ft (2,926 m) AGL. Base Order P3570.1 (SOP) prohibits overflights of the G-10, K-2, and N-1 Impact Areas during live fire operations, unless the aircraft is above the minimum altitude prescribed or is involved in the exercise.

Given the brief time duration of the Feasibility Study, and the precautionary measures to be taken, there would be no significant impact to transportation systems in the vicinity of Camp Lejeune.

4.5 Air Quality

There would be no significant impacts to air quality as a result of the Feasibility Study. The testing is of short duration (several hours over the course of one day). The 12 inert rounds contain no explosive materials. The explosive products of the 12 live rounds are similar to those generated by ongoing training activities at Camp Lejeune. The detonation process, including the continued combustion that occurs in the plume immediately after initial detonation, results in nearly complete combustion of these explosive compounds to form oxides of carbon, nitrogen, and water.

4.6 Noise

4.6.1 Noise from Troop Movements

The SFCP would contain only 10 personnel, all of whom are currently based on Camp Lejeune. The SFCP would be stationed near the G-10 Impact Area for each firing sequence. These limited troop movements would take place in maneuver areas and ranges that are subject to periodic increases in noise levels from similar, ongoing activities. Thus, there would be no significant noise impact from troop movements.

4.6.2 Noise from Sonic Booms

A sonic boom is a pressure wave formed by an object exceeding the speed of sound. There are several factors that can influence sonic booms including weight, size and shape of the moving object, plus its altitude, attitude, flight path, and atmospheric conditions. A larger and heavier object would create stronger and louder sonic boom than a smaller, lighter object. The speed of the object determines the angle relative to the flight path for the sonic boom.

In the Programmatic EA for Vieques (US Navy, February 2001) the Navy conducted analyses to determine if sound energy from sonic booms associated with 5"/54 guns during NSFS operations could possibly pose a health risk to children or adults swimming in the waters off the beaches of Vieques. The results of that analysis are applicable here.

A sonic boom is a separate and distinct pulse from a gun muzzle blast produced by the projectile fired. For low elevation firings the sonic boom will be less than the gun blast in the vicinity of the blast impingement point on the water. As the projectile travels away from the ship, its speed diminishes and the trajectory rises. This causes the sonic boom pressure incident on the water to decrease with distance away from the ship.

As indicated in the Subchapter 4.10.1, both theoretical and experimental methods have been used to determine the bow shock environment from 5" and 16" projectiles (Pater, 1981, and Miller, 1991). The near field (close to the projectile) was studied by firing 16" projectiles very close to a pressure sensor array. The far field was studied by firing 5"/54 caliber projectiles over instrumentation along the trajectory of the shells over a distance of several miles. Far field measurements were taken with the gun firing at an elevation of 10 degrees, and data were measured for 32 rounds. Surface sound pressure level measurements were taken beneath the trajectory at eight locations at distances ranging from 3,700 ft (1,128 m) to 48,284 ft (14,717 m) from the gun. The highest sound level measured was 145.1 dB (re 20 μ Pa), with the preponderance of data much lower (e.g. 120 – 90 dB re 20 μ Pa) (Pater 1981). Outside a round's line of flight, pressure decreases rapidly.

Using spreading rules for sonic booms as indicated in Subchapter 4.10.1, a maximum peak pressure in water of 195 dB (re 1 μ Pa) has been calculated for 5"/54 caliber sonic booms. This maximum

peak pressure in water equates to 0.815 pounds per square inch (psi). This peak value occurs in the water just below the muzzle of the gun and is considerably lower than the value of 50 psi (about 231 dB re 1 μ Pa) that has been established as one criterion for swimmer safety (Christian and Gaspin, 1974). The second of the two criteria requires that the positive impulse (integral of pressure over time during the initial positive pressure phase) be less than 2 psi-ms (about 15 Pa-s). Estimates of positive impulse from the cited data (e.g., Pater, 1981) approach 15 Pa-s only within a few meters of the ship.

Because the sound energy from sonic booms would be well within the standards to protect the safety of swimmers, and the maximum calculated sound energy from sonic booms along their trajectory would occur more than 10 miles (16 km) from the closest populated or public areas, people swimming in the waters of Onslow Bay would be completely safe.

Based on the 145-dB level observed at 3,700 ft (1,128 m) and the closest land-to-ship distance (greater than 37,000 ft (11,280 m)), the noise levels on land resulting from NGF would be expected to be in the 90-120 dB range discussed above. These levels are considered as low risk levels of disturbing the public (see Table 3-6). Therefore, the potential noise impact from the Feasibility Study would not be significant.

As part of the Feasibility Study, the Marine Corps will be conducting a noise monitoring program at approximately six locations in and surrounding Camp Lejeune. The specific scope of this monitoring program is to be determined.

4.7 Infrastructure

The SFCP would be made up of 10 personnel, all of whom are currently based at Camp Lejeune. No additional troops would be stationed at Camp Lejeune for this Feasibility Study. Therefore, there would be no impacts to water supply, wastewater treatment, or solid waste facilities.

With the exception of targets, no effects on any structures or facilities near the G-10 Impact Area are anticipated from this exercise.

4.8 Cultural Resources

Camp Lejeune has identified architectural and archaeological National Register sites (both listed and potential) on the Base. Additional cultural resource studies are underway to complete the inventory of archaeological sites.

A 1998 study identified the G-10 Impact Area as a danger area where safety concerns prevent archaeological activities (Louis Berger and Associates, 1998), and the NC State Historic Preservation Office subsequently concurred with this finding. However, damage to as-yet-unidentified archaeological or historical sites that have scientific value is considered unlikely, as

the proposed exercise would occur in areas that have been extensively used for previous training exercises. Soil disturbing maneuvers, principally resulting from the operation of vehicles in impact areas (to survey for accuracy of firing), would take place on areas currently used for such operations, reducing the possibility of uncovering any unknown artifacts. Because G-10 is an established impact area, it is likely that any archaeological sites therein no longer have integrity as defined in the criteria for nomination to the National Register of Historic Places. Therefore, there would be no effect to cultural resources as a result of the Feasibility Study.

4.9 Water Resources

The Feasibility Study involves firing 12 inert rounds and 12 HE rounds. Inert rounds are composed essentially of concrete, and would not adversely affect water quality. The HE rounds contain small amounts of trinitrotoluene (TNT) and cyclonite (RDX). Small amounts of other nitroaromatic compounds, such as octogen (HMX), tetryl, and picric acid, are also used in some applications. These compounds could potentially have an adverse effect on surface and groundwater quality. However, the explosive products are similar to those generated by ongoing training activities at G-10. The detonation process, including the continued combustion that occurs in the plume immediately after initial detonation, results in nearly complete combustion of these explosive compounds to form oxides of carbon, nitrogen, and water. Thus, it is unlikely that significant quantities of the parent explosives compounds or the combustion products would be released to the environment from bombing activities.

4.10 Marine Natural Resources

4.10.1 Marine Mammals

There are two areas of potential impact that need to be addressed with respect to marine mammals: the potential effects of naval gunfire noise and the potential for collisions with ships.

Noise Effects

This analysis addresses the potential for gun noise from NSFS to impact protected marine animals in the water. The contention, raised by some citizen groups, is that sound pressure from naval gunfire may propagate into the water and cause harm to marine mammals and other protected species via three mechanisms:

- Noise generated by the blast at the muzzle of the gun propagates through the air into the water;
- Impulse and vibration from the gun blast propagates via the hull of the ship into the water; and

- Sonic boom noise generated by the shell, as it travels to its target, propagates into the water.

Mechanisms for all three paths generate impulsive noise (of short duration and with fast onset of pressure), so that the appropriate impact criteria for marine animals are those for impulsive noise.

Based on measurements and studies conducted over the past 20 years (especially Pater, 1981, Yagla, 1986, USS Cole data, 2000), the Navy has characterized the noise generated by naval guns during NSFS. Of particular interest is the Naval Surface Warfare Center (NSWC) Dahlgren NSFS study conducted during the Vieques Inner Range June 2000 training exercise. Sound measurements were made during the firing of 5"/54 guns by the USS Cole.

The relevant results of these studies are presented below. However, it is first necessary to establish a set of criteria or standards against which to measure predicted noise levels.

Criteria and Thresholds

For impulsive noise in water, the Navy has previously evaluated criteria and thresholds for the potential injury and harassment of marine mammals and other protected marine species. The Navy's evaluations of criteria and thresholds have been based on experiments, actual measurements, and scientific theories for explosive noise, and the evaluations have been developed in cooperation with the medical community, wildlife biologists, and acousticians in government and academia. Although acoustic impact evaluation applications for marine mammals and marine species are relatively new, with data still emerging on sensitivity, there still exists a developing literature and public record on applications to marine mammals and marine species, and the Navy is leading the development of threshold criteria.

The criteria and thresholds that have been developed by the Navy and which are used in this analysis to assess potential harassment and injury to marine mammals are listed in Table 4-2. These criteria and thresholds were developed as part of the USS Seawolf Shock Test Final EIS (Navy, 1998), which was adopted by the NMFS in its final rule (NMFS, 1998) on unintentional taking of marine mammals incidental to the proposed USS Seawolf shock testing. As listed in Table 4-2, the criterion for marine mammal harassment is a dual criterion that consists of both an energy-based temporary threshold shift (TTS) criterion of 182 dB (re 1 $\mu\text{Pa}^2 \cdot \text{sec}$) and a peak pressure of 12 pounds per square inch (psi). A harassment impact range would be the maximum distance at which either of these two criteria would be exceeded.

Table 4-2

Seawolf FEIS Criteria and Thresholds

Criterion	Threshold
Harassment: all marine mammals and sea turtles except baleen whales, sperm whales, elephant seals, and California sea lions ⁽¹⁾	Energy flux density level in any 1/3- octave band above 100 Hz exceeds 182 dB re 1 $\mu\text{Pa}^2\text{-sec}$
Harassment for baleen whales, sperm whales, elephant seals, and California sea lions ⁽¹⁾	Energy flux density level in any 1/3- octave bands above 10 Hz exceeds 182 dB re 1 $\mu\text{Pa}^2\text{-sec}$
Harassment for all marine mammals	Peak pressure above 12 psi
Injury for marine mammals and sea turtles [(probability of 50 percent tympanic membrane (TM) (eardrum) rupture)]	Energy flux density greater than 1.17 in-lb/in ² (20.44 milli-Joules/cm ²)
⁽¹⁾ This criterion must be considered together with the threshold of a peak pressure above 12 psi. Reference: Seawolf Shock Trial FEIS (1998) and NMFS Final Rule (1998).	

Transmission of Sound into Water From Gun Muzzle Blast

When a gun is fired from a surface ship, a blast wave propagates away from the gun muzzle. The blast wave is spherical in shape, and reflects off and diffracts around objects in its path. When the blast wave meets the water, it reflects back into the air away from the water and transmits a sound pulse back into the water in proportions related to the angle at which it hits the water. The blast wave transmits propagating energy into the water only in a definite region below the gun. A critical angle beyond which no propagating energy is transmitted into the water can be calculated, and this critical angle (about 13 degrees as measured from the vertical) can be used to determine the region of transmission relative to a ship and gun. Pressure sensors and hydrophones placed into the region of the water where energy can be transmitted can measure the actual pressure entering the water. These measured pressure readings can then be converted to sound pressure levels in decibels (dB) referenced to a specific pressure in micropascals (μPa) and other units as necessary for comparison to marine mammal acoustic impact criteria and thresholds for impulsive sources.

Based on measurements and studies conducted over the past 20 years (especially Pater, 1981; Yagla, 1986; and Dahlgren, 2000), the Navy has determined the noise generated by naval guns during NSFS. Noise transmitted into the water from muzzle blast during the firing of 5"/54 caliber guns has also been determined and documented in a study performed by the Dahlgren Naval Surface Warfare Center Combat System Safety and Engineering Division (Dahlgren, 2000). As contained in this study, pre-test calculations of expected muzzle blast noise entering the water were performed by three different research personnel/organizations. These calculations yielded an estimated peak pressure level of about 195 to 205 dB (re 1 μPa) at the air-sea interface, about 10 meters below a 5"/54 caliber Naval gun muzzle. Subsequent to these pre-test calculations, a series of pressure measurements were taken during the firing of 5"/54 caliber gun blasts aboard the USS Cole in June 2000. The average pressure measured was about 200 dB (re 1 μPa) at the point of the air and water interface. Down range peak pressure levels, estimated for spherical spreading of the sound in water, were calculated based on the USS Cole data to be less than 186 dB (re 1 μPa) at 100 meters. The pressure would be less than this at greater distances. The peak pressure is less than the Seawolf harassment threshold of 12 psi (219 dB re 1 μPa).

As for the second of the two harassment criteria from Seawolf, note that the energy flux density (EFD) levels (greatest in any 1/3 octave band above 10 Hz) were calculated to be 190 dB (re 1 $\mu\text{Pa}^2\text{-sec}$) below the gun muzzle and 170 dB (re 1 $\mu\text{Pa}^2\text{-sec}$) at 328 ft (100 m) in the water. The range to the 182 dB (re 1 $\mu\text{Pa}^2\text{-sec}$) harassment threshold identified in Table 4-2 would be about 98 ft (30 m). The proximity of the calculated threshold distance to a firing ship in conjunction with the standard operating procedures that would be implemented by the Navy to watch for the presence of marine mammals and abort operations until the area has been cleared if marine mammals are present would ensure that no marine mammals would be adversely affected.

Transmission of Sound and Vibration Through a Ship Hull

A gun blast also sends sound waves into the ship structure. The structure-borne sound can also enter the water and propagate away from the ship.

Gun noise entering the water by propagation of sound pressure via the hull of a ship was investigated in conjunction with the measurement of gun blasts aboard the USS Cole in June 2000 as part of the study prepared by the Dahlgren Naval Surface Warfare Center Combat System Safety and Engineering Division (Dahlgren, 2000). As contained in this study, the structural borne component of the sound consisted of low level oscillations on the pressure time histories that preceded the main pulse due the air blast impinging on the water. The structural component for a typical round was found to be 6.19 percent of the air blast, and, therefore, judged as small and not analyzed any further. Because gun noise entering the water via the hull of a ship is only a very small percentage of the sound entering the water from a gun blast, and the acoustic impact of a gun blast (which includes sound via the hull) is unlikely to significantly impact marine mammals, gun noise via the hull would not adversely affect marine mammals.

Transmission of Sound through Air and into Water for a Sonic Boom

The sound generated by a shell in its flight at supersonic speeds above water is transmitted into the water. The Navy has performed extensive studies of the bow shock environment from 5" and 16" projectiles (Pater, 1981, and Miller, 1991). Both theoretical and experimental methods have been used. The near field (close to the projectile) was studied by firing 16" projectiles very close to a pressure sensor array. The far field was studied by firing 5"/54 caliber projectiles over instrumentation along the trajectory of the shells over a distance of several miles. Far field measurements were taken with the gun firing at an elevation of 10 degrees, and data were measured for 32 rounds. Surface sound pressure level measurements were taken beneath the trajectory at eight locations, on the ground, at distances ranging from 3,700 to 48,284 ft (1,128 to 14,717 m) from the gun. The highest peak pressure level measured in air was 145.1 dB (re 20 μPa), with the preponderance of data much lower (e.g., 120 – 90 dB) (Pater, 1981)

Based on the data in Miller (1991), the equivalent source level for a sonic boom shock wave from a 5"/54 caliber gun shell is about 210 dB (re 1 μPa) at 1 meter. Because the shock wave is incident on the ocean surface at angles less steep than critical, the transmitted wave in water is evanescent (i.e., it does not propagate and the pressure falls off exponentially with depth). When one assumes

horizontal firing from a 5"/54 caliber gun at a height of 35 ft (11 m) above the water, the spreading rules for sonic booms (e.g., Pater, 1981) and the above source strength result in a maximum peak pressure in water of 195 dB (re 1 μ Pa), or about 0.8 pounds per square inch (psi). This is well below the 12 psi (219 dB) threshold for harassment for marine mammals as indicated in Table 4-2. The estimated energy flux density level in the greatest 1/3 octave band above 10 Hz is 180 dB (re 1 μ Pa²-sec), which is also less than the 182 dB harassment threshold indicated in Table 4-2. Away from the line of flight or as the shell altitude increases, the levels are lower, decreasing logarithmically according to $-15 \log$ (range in meters).

Conclusions

In summary, the sounds generated by 5"/54 naval gun firing during NSFS would all be below injury and harassment levels for marine mammals beyond 98 ft (30 m) from the ship. The closeness of the 98-ft (30-m) radius in conjunction with the standard operating procedures that would be implemented by the Navy to watch for the presence of marine mammals and abort operations until the area has been cleared if marine mammals are present would ensure that no marine mammals would be harassed.

Potential for Ship Collisions

Collision with marine mammals by ships participating in the training would be avoided by the following measures:

- All surface vessels would have two lookouts with binoculars. The duty of the lookouts is to watch for and report to the Officer of the Deck regarding all things in the water with which the vessel may collide, including marine mammals and sea turtles.
- Naval vessels would avoid approaching any whale head on, and would maneuver to keep at least 500 yards (457 m) away from any observed whale.
- Naval vessels shall be alert at all times, use extreme caution, and proceed at a "safe speed" so that the vessel (1) can take proper and effective action to avoid a collision with a whale, other marine mammal, or other listed species; and (2) can be stopped within a distance appropriate to the prevailing circumstances and conditions.

Qualification standards for lookouts include training on marine mammals, as well as all sea life. Lookouts are trained to stay alert to any objects in the water so that collisions can be avoided. Therefore, through adherence to the above operational guidance, ship movements would not affect marine mammals or other protected species.

4.10.2 Turtles

Sea turtles are generally present in Onslow Bay in nearshore waters during the September to November period. Nesting activity begins in late May and lasts through August, with peak activity occurring in June and July. Unlike marine mammals, little is known about the role of sound and hearing in sea turtles. Although they can hear low frequency sound, such as that generated by gun blasts, there is limited information on sea turtle behavioral and physiological responses to low frequency sound underwater (Eckert, 1998, in DON, January 2001).

In the few cases in which low frequency hearing has been studied in sea turtle species, individuals tested showed low sensitivity. Lenhardt (1994; in DON, January 2001), in an unpublished presentation, suggested that maximum sensitivity in sea turtles occurred between 100 and 800 Hz. Ridgway et al. (1969) found 300 and 400 Hz as the maximum sensitivity for green turtles, with a rapid decline in sensitivity for lower and higher signals. This study did not measure hearing capabilities in terms of behavioral responses, as has been done for fish and sharks, but directly measured responses from the ear. While such studies are useful in giving a general indication of sensitivity of the ear to sounds (to both intensity levels and frequency ranges), they generally give only a limited picture of the actual hearing capabilities of an animal.

The effects of sound pressure levels on the hearing of sea turtles are unknown. Other analyses have used a conservative level of 160 dB for defining the potential effect to sea turtles, but based on the few studies to date this represents a level that is probably lower than the actual sensitivity level of these species.

The mitigation measures outlined in the subchapter on marine mammals would also be applicable for the protection of sea turtles; thus, the potential to “take” a turtle would be negligible.

4.10.3 Fisheries

Potential effects of low frequency sound on fish could include permanent or temporary hearing loss, masking of biologically important sounds, and resonance of gas-filled organs (such as swimbladders). However, even if fish were killed or injured as a result of the Feasibility Study, because the noise generated would be limited to several minutes within two one-hour spans, the impacts on overall fish stocks would be negligible in comparison to the number of fish taken through normal commercial fishing activity.

Sargassum habitat and live/hard bottom habitat are the two essential fish habitats that can be found within Onslow Bay. Sargassum habitat is a floating habitat usually associated with open ocean. Although occasional pieces of sargassum may float through the Bay depending on prevailing currents, a year-long study of aerial photos did not identify any sargassum in the Bay. It is unlikely that noise would adversely affect the sargassum itself or the organisms associated with it, particularly considering the short-term nature of this exercise. Live/hard bottom habitat is

largely found along the continental shelf outside and seaward of the N-1/BT-3 range, and no impacts to live/hard bottom habitat are expected.

4.10.4 Protected Species

Noise and physical impacts on marine mammals are addressed in Subchapter 4.10.1. The mitigation measures proposed for protection of marine mammals, which would also affect sea turtles, would ensure that the potential to “take” a threatened or endangered animal by noise or physical injury is negligible; therefore, there would be no effect on protected species due to implementation of the Feasibility Study.

4.10.5 Coral Reefs

No coral reefs are present within the N-1/BT-3 range. Therefore, the Feasibility Study would have no impact on coral reefs.

4.11 Land Natural Resources

4.11.1 Topography, Geology, and Soils

The inert and high explosive rounds fired into the G-10 Impact Area would have a minor impact on G-10 soils. This area has been used historically, and is still being used, for similar purposes; thus, the disturbance from the 12 high explosive 5”/54 rounds would not be significant.

4.11.2 Floodplains

A considerable portion of the G-10 Impact Area is within the 100-year floodplain. However, the firing of rounds into these areas would not affect its flood storage or flood-buffering capacity. Thus, the Feasibility Study would not affect the capacity of this area to reduce damage to property, nor to provide the natural and beneficial functions associated with floodplains.

4.11.3 Vegetation and Wetlands

Plant communities within the target and buffer areas of G-10 include longleaf pine savannas, pond pine pocosins, and streamhead pocosins. These communities are currently frequently disturbed by the release of ordnance and periodic fire management. The release of 12 inert and 12 high explosive rounds into the target area, while it may damage individual plants, would have little impact on plant communities. Potential impacts on rough-leaved loosestrife are discussed in Subchapter 4.11.5.

4.11.4 Wildlife

The G-10 Impact Area has been used, and will continue to be used, for training similar to the SFCP training that is the concern of the Feasibility Study. While NGF has not been conducted at Camp Lejeune for a number of years, training with artillery from tank, helicopter, amphibious craft, and riverine assault craft platforms, as well as small arms training, has been ongoing. G-10 is one of the three major impact areas at Camp Lejeune. Therefore, it is reasonable to assume that the wildlife inhabiting or using the impact area are those species acclimated to the noise and disturbance generated by these activities. The Feasibility Study is similar in nature to these activities, and would not adversely affect wildlife through noise or startle reactions.

There is a very low probability that a round, inert or high explosive, could directly impact an animal. With the exception of individuals of the threatened or endangered species addressed in Subchapter 4.11.5, the mortality of a single animal would be unlikely to affect the survival of the species or local populations of that species.

4.11.5 Threatened and Endangered Species

The Feasibility Study may affect but is not likely to adversely affect threatened and endangered species in the G-10 Impact Area based on the following considerations:

- The **red-cockaded woodpecker** (RCW) groups residing in the G-10 Impact Area buffer zone have relatively high productivity. Associated foraging areas would not likely be affected by the Feasibility Study. High explosive rounds would not introduce impacts or disturbance to the G-10 Impact Area that differ from what is currently experienced. Thus, the Feasibility Study may affect but is not likely to adversely affect RCW.
- Two concentrations of **rough-leaved loosestrife** (RLL) fall within the NSFS buffer area at the southeasternmost edge. High explosive rounds would not introduce impacts or disturbance to the G-10 Impact Area that differ from what is currently experienced. The Feasibility Study does not significantly increase the probability of impacts to these RLL groups. Therefore, the Feasibility Study may affect but is not likely to adversely affect RLL.
- As with RLL, both state endangered and the four state candidate species fall within the NSFS buffer area. Given the current and historical use of the site, and the fact that the Feasibility Study would not significantly increase the probability of impacts to these species, the study may affect but is not likely to adversely affect state endangered or candidate species.

These conclusions are supported by the results of a 1999 USFWS Biological Opinion and recent informal consultation with the USFWS. The 1999 Biological Opinion concerned: depiction of the G-10 Impact Area in the latest Camp Lejeune Military Installation Map; target modification within the G-10 relative to RLL and RCW habitat; and mitigating actions to offset potential impacts to federally-listed species. The USFWS concurred with the Base's conclusion that use of the latest military installation map may affect but is not likely to adversely affect federally-listed species at the installation. The USFWS also agreed with Camp Lejeune's position that target realignment within the G-10 Impact Area may affect but is not likely to adversely affect federally-listed plants or animals.

In the August 2001 informal consultation between Camp Lejeune and the USFWS, the USFWS concurred that the proposed SFCP/NSFS is not likely to adversely affect the RCW, RLL or any other federally-listed species, their formally designated critical habitat, or species currently proposed for federal listing under the ESA.

4.12 Hazardous Materials/Wastes

The inert rounds to be fired into the G-10 Impact Area consist of concrete encased in metal jackets. These rounds would not contain hazardous or toxic materials.

The primary contaminants likely to be released while using live ordnance during training exercises include trinitrotoluene (TNT) and cyclonite (RDX) (URS et al, August 2000). Records indicate that lesser amounts of a number of other nitroaromatic compounds, such as octogen (HMX), tetryl, and picric acid, are also used in some applications, such as fuses and primers. It is important to note that the detonation process, including the continued combustion that occurs in the plume immediately after initial detonation, results in nearly complete combustion of these explosives compounds to form oxides of carbon, nitrogen, and water. Thus, it is unlikely that significant quantities of the parent explosives compounds or the combustion products would be released to the environment from bombing activities.

The Marine Corps personnel will follow the procedures established by Base Order P3570.1 for the handling of hazardous materials and POL. Thus, there would be no release of these contaminants during the Feasibility Study.

4.13 Safety

Marine Corps Order 3570.1A and Army Regulation 385-63 establish policies and procedures for firing ammunition for training, target practice, and combat. These regulations include standards used for determining SDZs for target areas. Table 4-3 provides definitions of the terms used to describe and define impact areas. Figure 4-1 provides a graphic description of an impact area.

The Navy/USMC has existing data from studies of naval gunfire. These data are used in a model called statistical weapons system to derive the SDZ diagrams (safety fans) for a particular exercise. Safety computations were performed that take into consideration the type of gun to be fired, the water depth required for the ship, and the distances the ship would be from the target within two possible Fire Support Areas. Those safety calculations resulted in the impact areas shown in Figure 4-2.

In this Feasibility Study the ship would use a Fire Support Area (FSA), rather than a Fire Support Station (FSS). An FSS is a stationary point from which the ship may fire. The problem with limiting the ship to a stationary point (FSS) is that ship positioning is inherently less accurate as it is more susceptible to winds and currents. An FSA is an imaginary box (area) that permits the ship to maneuver while firing and makes it less susceptible to winds and currents. The FSA would be a defined area in water with a depth of 46 ft (14 m) or greater off the coast of Camp Lejeune. An FSA allows the ship to maintain a constant course and speed, from which it can pinpoint its position as accurately as a surveyed artillery position. Using an FSA increases safety in that it allows the ship to make instantaneous corrections in order to ensure accurate delivery of the ordnance to the target.

By plotting the left and right limits of fire, a safety fan from each of the four corners of the specific FSA, and ruling out all areas of concern from each point, an acceptable NGF Target Area can be defined. This Target Area can be safely fired into from any position within the defined FSA. The larger NGF Impact Area (Figure 4-2) is the area where 99.9 percent of NGF rounds fired would impact. The NGF Impact Area lies within the existing boundaries for the G-10 Impact Area.

Table 4-3

Surface Danger Zone and Impact Area Terms

Term	Definition
Surface Danger Zone	That segment of the range area which is endangered by a particular type of weapon firing and which consists of the areas below.
Target Area	The point or location to which the weapon is to be fired.
Impact Area	The primary danger area for indirect fire weapons that is established for the impact of all rounds. The impact area is within the approved SDZ.
Probable Error	Measure of the impact distribution in the dispersion pattern around the center of impact, dimensionally expressed in firing tables as one interval of the dispersion rectangle.
Area A	The area (secondary danger area) which parallels the impact area laterally and which is provided to contain fragments from items exploding or ricocheting on the right or left edge of the impact area.
Area B	The area (secondary danger area) which is on the downrange side of the impact area and Area A. It is designed to contain fragments from items exploding on the far edge of the impact area.
Area C	The area (secondary danger area) which is on the uprange side of the impact area and parallel to Area B and which is intended to contain fragments from items exploding at the near edge of the impact area (also referred to as the short limit of the target area).
Area D	The area which is between Area C and Area E and which is considered a safe area for troop occupation for training purposes.
Area E	The area which is between Area D and the firing position and which is endangered by muzzle debris, overpressure, and injurious noise levels. Area E may be occupied only by weapon crews firing from an approved tactical configuration (circular, box, star, etc.).
Source: MCO P3570.1A, Ch.1. Policies and Procedures for Firing Ammunition for Training, Target Practice, and Combat.	

Recent technological advances in NSFS Fire Control Systems (e.g., new NGF technology uses Global Positioning Systems, gyro-stabilized guns, and computer generated solutions), munitions, and tactics techniques and procedures have greatly increased accuracy and reliability of NGF; consequently, SDZ and statistical weapon system data show that firing NGF into the G-10 Impact Area would be safe. In fact, improved NSFS safety allows clearance of overhead fires identical to cannon artillery.

The same laws of physics apply to all ballistic weapon systems (artillery, mortars, naval guns, rifles, etc.). If a projectile is fired at an angle of less than 10 degrees, there is a chance that it will skip on the ground, making its movement less predictable. The best way to describe skipping with regard to weapons is to liken it to skipping a flat rock on the surface of a calm lake. The same bouncing effect may occur if a ballistic projectile strikes a target at an angle of less than 10 degrees. The chance of skipping is greatly reduced if the projectile is fired at an angle of 10 degrees or higher. The existing Camp Lejeune Range Procedures (Base Order P3570.1A) and Marine Corps Artillery Safety SOP, Appendix J) reduce the chance of skipping even further by prohibiting artillery from shooting at an angle lower than 15 degrees.

In accordance with Camp Lejeune's existing procedures, naval guns would not fire at an angle of less than 15 degrees during the Feasibility Study. At 15 degrees or greater, NGF has a higher trajectory and falls at a steeper angle than currently authorized artillery operations. The steeper angle of fall results in an even lower probability of skipping a round; therefore, firing NGF rounds into the G-10 impact area has no greater chance of producing a skipped round than currently authorized and routinely conducted artillery fire into G-10.

The probability of a round skipping (whether artillery or NGF) is also affected by the nature of the ground surface upon which the round impacts. At G-10, the soft composition of the soil further diminishes the potential for a round to skip and the large number of trees and other natural obstacles would provide a natural backstop.

4.13.1 Comparison to Artillery Fire

Execution of NGF can be compared to the currently-employed M198 artillery fire as graphically depicted in Figure 4-3. For the purpose of evaluating impacts, the propensity for skipping and the margin of error are relevant. For both munitions, shooting at a low angle increases the likelihood of skipping. As discussed above, Camp Lejeune procedures prohibit artillery from shooting at an angle less than 15 degrees to prevent skipping. Naval guns also would not fire at an angle less than 15 degrees. This would prevent NGF from having any greater potential for skipping than currently exists with artillery fire.

The terminal velocity and projectile weight (representing the total force of the round as it hits the ground) in conjunction with the angle of fall are the factors that contribute to the probability of skipping. A naval gun 5"/54 round at 9.3 miles (15 km) has nearly the same terminal kinetic characteristics as a M198 155 mm artillery round fired at 6.2 miles (10 km) except that it is 25

pounds (11.3 kilograms) lighter. Thus, the likelihood of NGF rounds skipping is less than that of artillery.

The firing characteristics of ammunition used for NGF is similar to that of M198s. The target area buffer zones are based on the standard deviation in range (long or short of target) and deflection (left or right of target). The difference in standard deviations is a result of the differing velocities of the projectiles. Table 4-4 provides the standard deviations of the M198 155 mm and the 5"/54 NGF rounds.

Figure 4-3

Comparison of the Margin of Error for Naval Gun Fire vs Artillery

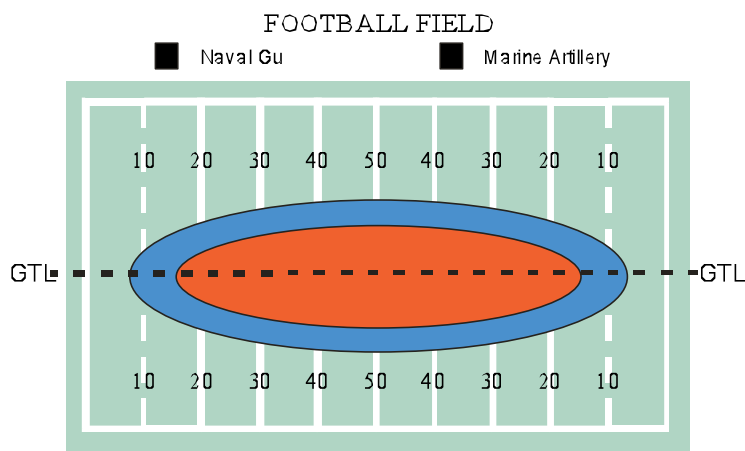


Table 4-4

Comparison of Standard Deviations (SD) of M198 and NGF Firing

Range	Error	M198 (SD)	NGF (SD)
15 km	Range	66 m	80 m
	Deflection	15 m	40 m
18 km	Range	78 m	85 m
	Deflection	23 m	45 m

4.13.2 Access Restrictions

G-10 is an established impact area for live fire. The short duration of the Feasibility Study (about two hours) and firing (several minutes at most), along with the fact that G-10 is a long-established range, help to minimize concerns about safety. The use of G-10 does not require the shutdown of any adjacent ranges, NC 172, Lyman Road, or the AIWW. However, as an additional measure of safety, NC 172, Lyman Road, and the AIWW would be closed during this

study. NC 172 and the AIWW have been closed off for training in the past, and existing procedures for closure would be followed for this study.

It is also important to note that there are no residences under the gunfire trajectories; the closest residential area to the NGF Impact Area is about 2.5 miles (4 km) away. With respect to State Park operations, the Marine Corps would communicate with the North Carolina Division of Parks and Recreation to inform them when the Feasibility Study would occur.

Based on the safety computations and precautions described above, as well as the phased approach to the study as described in detail in Chapter 2, no significant impacts with respect to safety are expected as a result of the Feasibility Study.

4.14 Cumulative Impacts

Cumulative impacts have been defined by the Council on Environmental Quality (CEQ) in 40 CFR 1508.7 as:

Impacts on the environment which result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions.

The CEQ regulations further require that NEPA environmental analyses address connected, cumulative, and similar actions in the same document (40 CFR 1508.25). This requirement prohibits segmentation of a project into smaller components to avoid required environmental analysis.

This EA evaluated information relevant to environmental concerns associated with the Feasibility Study. The analyses conclude that there would be no significant environmental impacts as a result of the proposed action. Any impacts associated with the Feasibility Study would be localized and temporary (less than 2 hours) in nature and barely discernable from past and existing training activities.

It is foreseeable that as a result of this Feasibility Study further actions to utilize the G-10 area for SFCP training may be proposed. Such proposals would be based upon the success of the proposed Feasibility Study and analysis of data collected during its conduct. Data collected during the Feasibility Study would then be utilized in a subsequent NEPA analysis to predict and assess the significance of any long-term impacts.

4.15 Unavoidable Adverse Impacts

Based on the analysis in this EA, there would be no unavoidable adverse impacts due to the Feasibility Study at Camp Lejeune.

4.16 Relationship Between Local Short-Term Uses of Man's Environment and the Enhancement of Long-Term Productivity

Short-term uses of the environment are those that occur over a period shorter than the life of the Proposed Action. Long-term uses include those impacts that would persist for a period of five years or more, or for the life of the Proposed Action.

The Proposed Action represents a short-term use of the environment. However, it would have a negligible impact on other, more long-term uses, such as use of the area's natural resources, or use of the area for ongoing training activities.

4.17 Irreversible and Irretrievable Commitments of Resources

The proposed Feasibility Study would expend fuel, ammunition, and labor. However, if the results of the study prove that Camp Lejeune is a suitable location for SFCP, the use of Camp Lejeune for this activity could lead to major fuel and labor savings. These exercises are presently conducted at the Vieques Inner Range in Puerto Rico or San Clemente Island in California, at a major expenditure in terms of manpower hours (time for personnel to travel to these destinations from locations on the East Coast) and fuel (time for naval gunfire ships to steam to Vieques from Norfolk, Virginia).

4.18 Mitigation Measures

A variety of mitigation measures have been developed to minimize any potential environmental impacts, as described below.

For Marine Corps Base Camp Lejeune, North Carolina, the Consolidated Public Affairs Office would be designated to receive inquiries and/or comments from the public during the study. The telephone number is (910) 451-7440.

4.18.1 At Sea Activities

The following restrictions are applicable to all ships participating in the Feasibility Study:

- Vessel operators will be cautioned to avoid sea turtles and marine mammals.
- All surface vessels will have two lookouts with binoculars. The lookouts will search the area for marine mammals and sea turtles and report sightings to the Officer of the Deck regarding all things in the water with which the vessel may collide, including whales and sea turtles.
- The participating vessels will avoid approaching any whale head on, and will maneuver to keep at least 500 yards (457 m) away from any observed whale.
- While in transit, Naval vessels will be alert at all times, use extreme caution, and proceed at a “safe speed” so that the vessel: (1) can take proper and effective action to avoid a collision with a whale, other marine mammal, or other listed species; and (2) can be stopped within a distance appropriate to the prevailing circumstances and conditions.
- Vessels participating in the Feasibility Study will not discard refuse overboard or pump bilges while in the waters of Onslow Bay.

4.18.2 Noise

- As part of the Feasibility Study, the Marine Corps will be conducting a noise monitoring program at approximately six locations in and surrounding Camp Lejeune. The specific scope of this monitoring program is to be determined.

4.18.3 Threatened and Endangered Species

- Flora and fauna will not be needlessly damaged or destroyed.
- The SFCP personnel will receive a copy of Camp Lejeune Base Orders 11015.6C and 11015.7C, "Terrestrial Threatened and Endangered Species Protection Program/Measures and Sea Turtle Protection Program" and will abide by the restrictions presented in the Base orders.
- Camp Lejeune contains 65 red-cockaded woodpecker cavity tree clusters. These areas are protected by a 200-foot (61-m) buffer zone clearly marked with single bands of white paint and signs reading “Restricted Area Endangered Species Site, No Vehicles Allowed”, and “Endangered Species Colony Site.” Tracked and wheeled vehicles are restricted to using existing well-defined, main roads/trails in these areas. Within the marked RCW sites, specific ground training activities are prohibited.

4.18.4 Cultural Resources

- If any site of potential historical or archaeological significance (i.e., evidence of human activity during the World War II era, or earlier) is encountered during the study, the installation commander will be notified. The unit commander will order actions in the vicinity halted and the area marked. The unit commander will immediately notify the Base Archaeologist at telephone 451-2148.

4.18.5 Safety

- Fire danger risk for the day will be obtained from Base Range Control Officer and associated restrictions observed. Should a wildfire occur, the unit observing the wildfire will immediately contact the Base Range Control Office, tel. 451-3064 (Blackburn) or Base Range Control Office Safety, frequency 3860 FM.
- The AIWW will be closed for a maximum of two hours during conduct of the Feasibility Study. The closing will be coordinated with, and approved by, the Coast Guard, and a Notice to Mariners published to inform mariners of the closing times and dates.
- Similarly, NC 172 and Lyman Road will be temporarily closed (two hours) during conduct of the Feasibility Study.
- Training areas GC, GD, GE, GH, and GI would be closed during the entire test.

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APPENDIX A
AGENCY CORRESPONDENCE